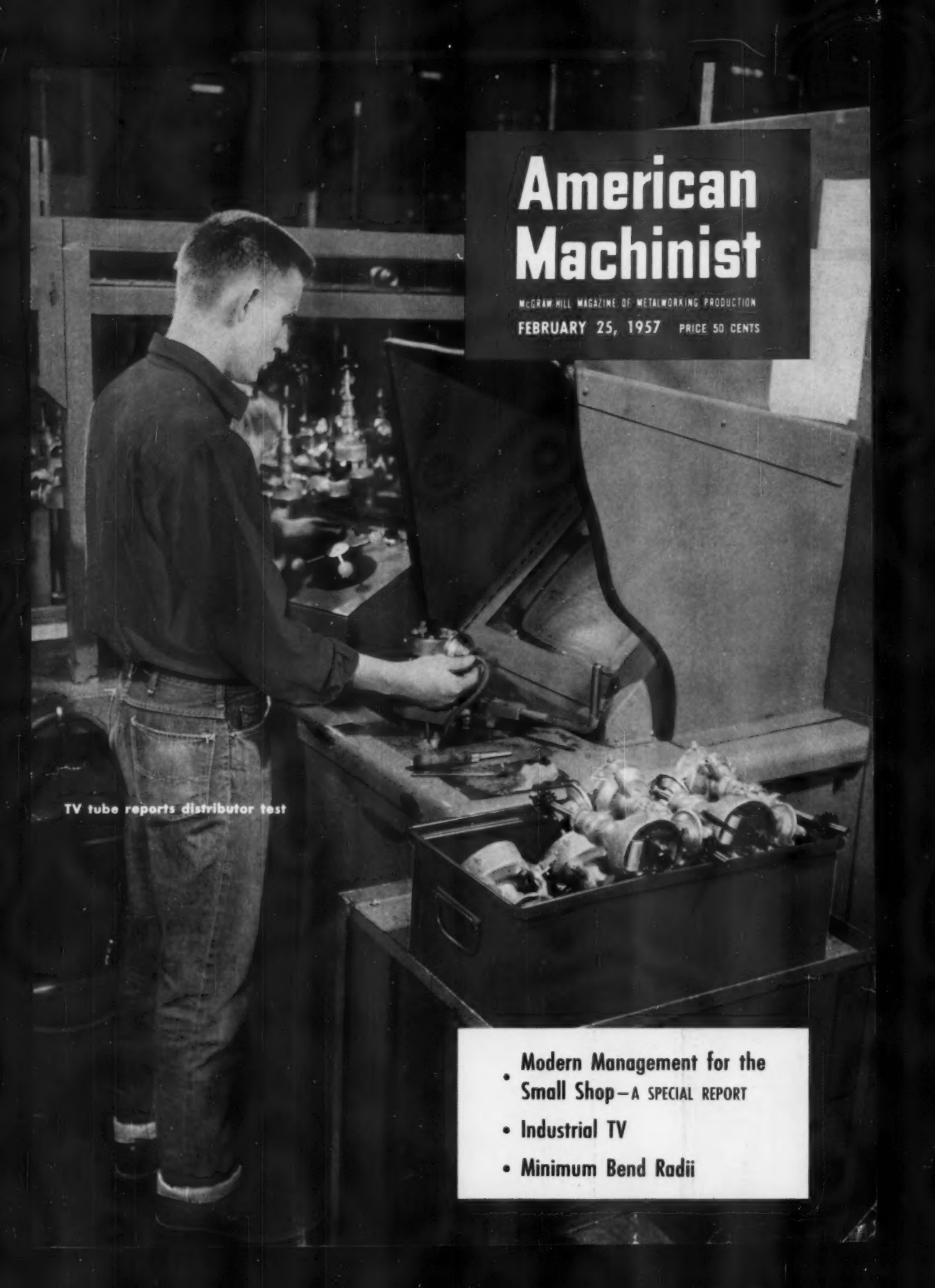


American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

FEBRUARY 25, 1957 PRICE 50 CENTS

TV tube reports distributor test

- Modern Management for the Small Shop—A SPECIAL REPORT
- Industrial TV
- Minimum Bend Radii

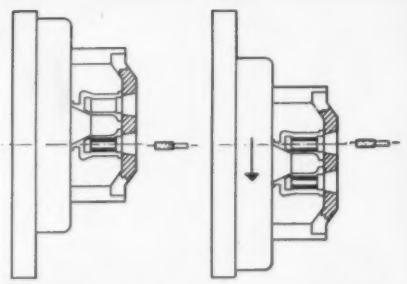
AUTO-INDEXING permits

single chucking for double bore grinding

Manually re-locating a part to grind a *second* bore takes valuable operator time. This time can be saved, in many instances, by the use of an auto-indexing fixture on a Heald Internal Grinder. For example, the Model 271 Size-Matic shown below precision grinds *two* interrupted bores in a universal joint body in a single, fully automatic, 71-second cycle.

The diagrams at right show how both bores of the work are brought in line with the grinding wheel — automatically!

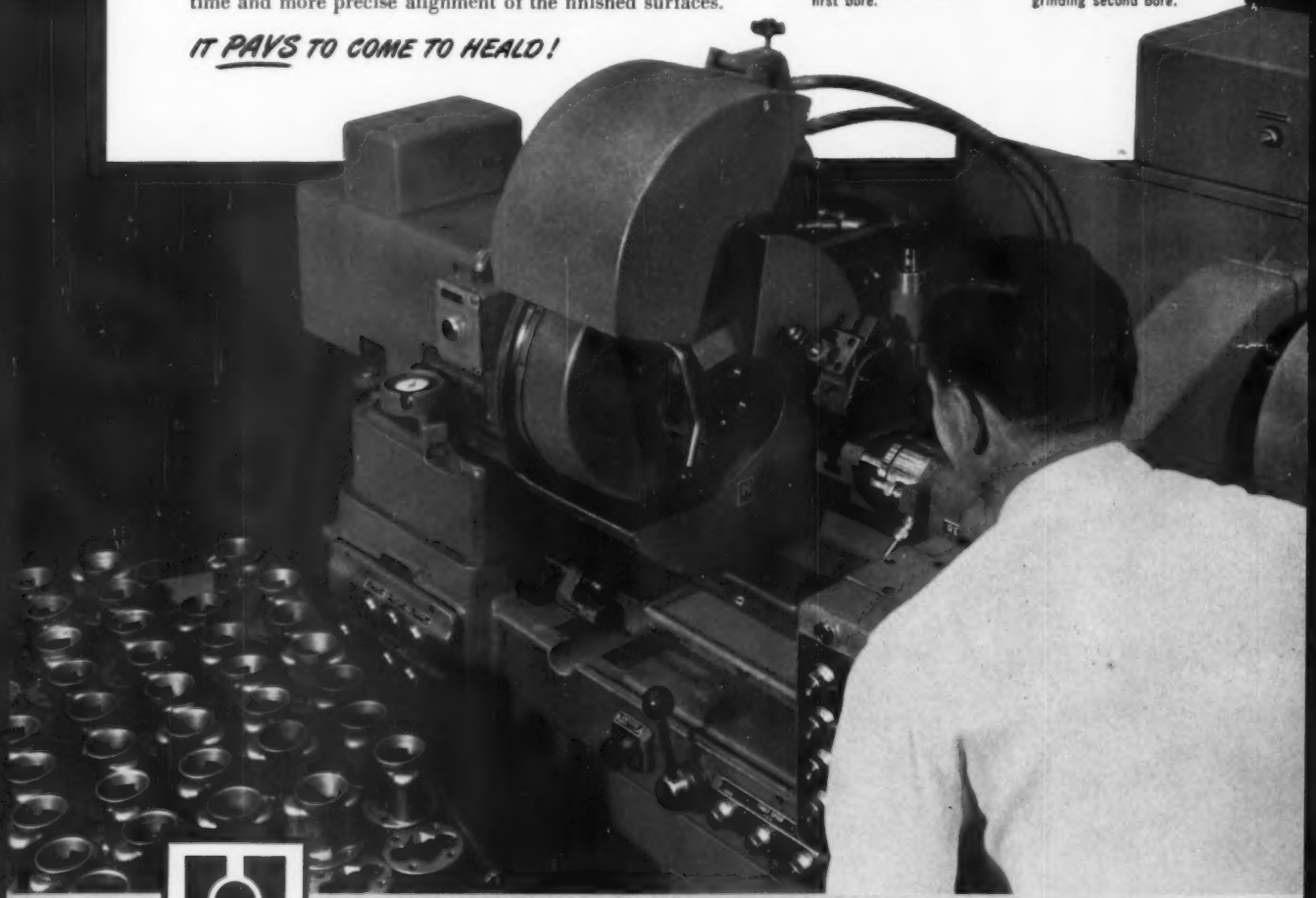
This auto-indexing feature can be used for many two-bore grinding jobs of this type with substantial savings in handling time and more precise alignment of the finished surfaces.



Auto-indexing fixture in position for grinding first bore.

Rotary cross-feed unit indexed to position for grinding second bore.

IT PAYS TO COME TO HEALD!



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THE **HEALD** MACHINE COMPANY

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Production planning for the Crusader . . . Only 26 months from first flight to line production because of the emphasis on producibility. *By John R Saul, Chance Vought Aircraft, Inc.* **126**

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American Machinist *Chips*

Cover . . .
One of a battery of all electronic test stands for distributors built for Ford Motor Co by Airborne Instruments Laboratory. Story on page 191.

Modern management . . . One of the advantages that the large metalworking company has had over the small one, has been the ability to apply the techniques developed in recent years for control of operations and costs. We tend to distinguish plants that take advantage of these opportunities from those that don't by saying the former have "modern management" methods.

Now it is no longer necessary for the small shop that can't afford a platoon of business-school graduates to labor under this disadvantage. Two experienced management consultants have agreed to prepare a series for our readers in which they "tell all." By careful use of the information in this series, you will be able to apply these methods to your own business. We introduce the series with the Special Report in this issue. This Report (see page 129) summarizes the benefits of modern management methods and outlines the procedures. Each of these steps will be discussed in full detail as the series unfolds. But we urge you to study this opening report carefully and to begin your planning now.

Vought takes a Chance . . . In planning the Crusader supersonic fighter for the Navy, Chance Vought staked a lot on producibility planning in the early stages of development. The payoff comes next month when the planes reach Navy squadrons in quantity just 26 months after the first test flight. John R Saul describes the planning that made this possible in the article on page 126.

A good example of the Chance Vought approach is in their development of a formability index to determine minimum bend radii. William W Wood (see biography) describes this development and gives you the resulting nomograph in our lead article.

Startling details on Russian automated factories raised the question: Where did the USSR get machinery like this so quickly? The answer, showing how special machines are built from concept to delivery in less than nine months, by spreading orders throughout the industry, appears in Russian Report No. 6 starting on page 178.

Coming . . . *AM* for March 11 will feature a report on some outstanding tooling developments at Grumman Aircraft. You will find Step 9 in J R Paquin's popular "14 Steps to Design A Die"—this one on the design of automatic stops. There will be articles on automation of stamping, trimming operations, handling for heat treating, plus all the usual departments.

William W Wood . . .
is supervisor of manufacturing research at Chance Vought Aircraft in Dallas, Texas. Born in Oklahoma, he started work as a toolmaker for Convair, spent the latter part of the WW II with a Navy PT boat squadron in the Pacific. After that he studied at Midwestern University and MIT where he received his BS and MS in mechanical engineering, then joined Chance Vought in 1953. His article on minimum bend radii is on page 121.

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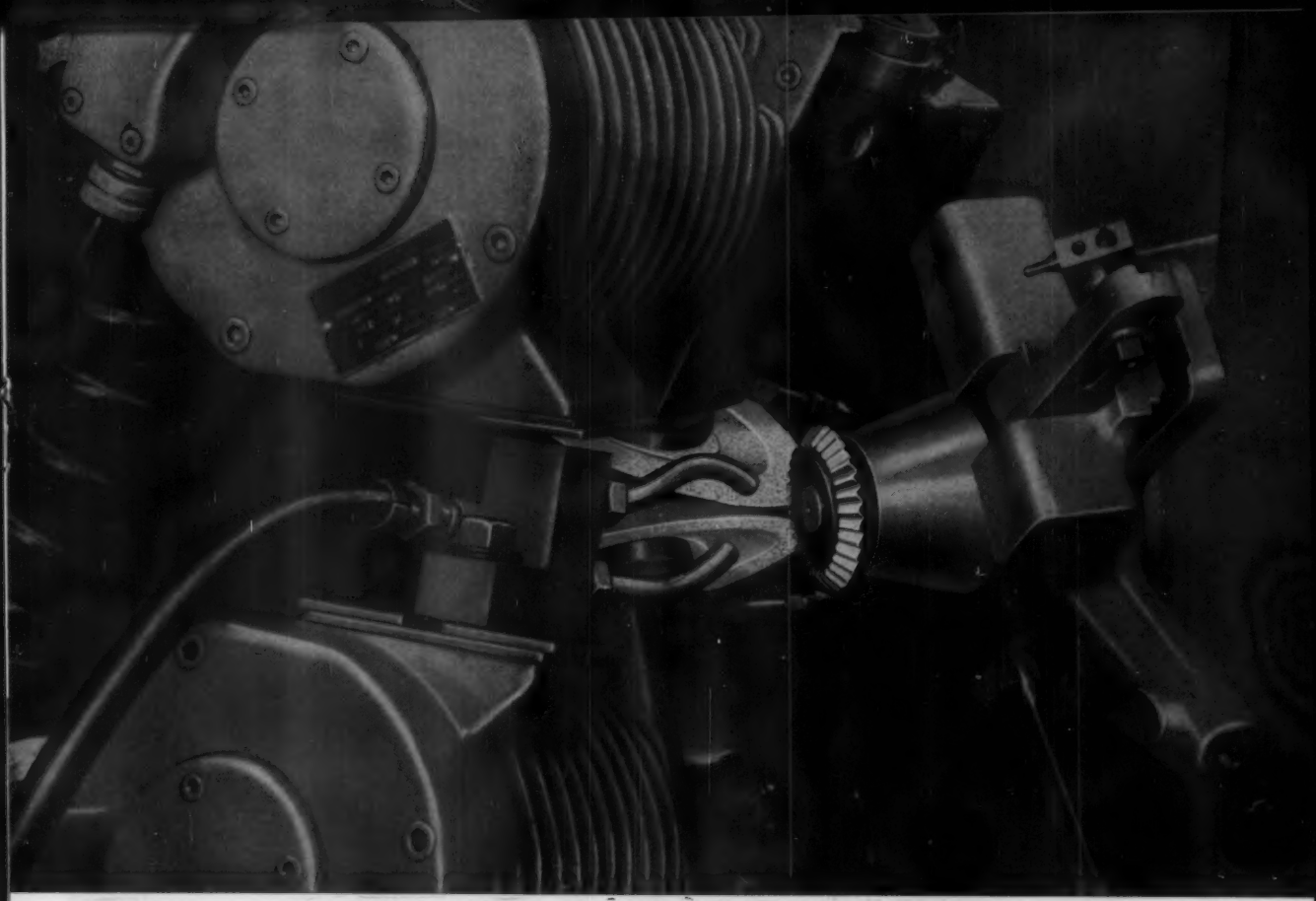

Now you can grind straight bevel Coniflex® gears

You can *now* use hardened and ground straight bevel gears for many angular drives requiring extreme precision and load carrying capacity.

The new Gleason No. 105 Straight Bevel Coniflex* Grinder generates gears with the highest accuracy of spacing and profile, with the tooth profile, fillet radius, and tooth bottom formed into one smooth blended shape by two grinding wheels.

And gears ground on the No. 105 Grinder after hardening *maintain their extreme precision* even under continuous load operation.

Wet-type grinding on this machine provides fast cycles and excellent finish. Set-up calculations are simple. The completely automatic cycle of the No. 105 Grinder not only assures uniformity of production but also provides great savings in time and production costs.

We will gladly send you more information about the No. 105 Straight Bevel Coniflex Grinder upon request.

The No. 105 Grinder accommodates straight bevel Coniflex gears up to 8½" pitch diameter, 3DP with ratios up to 6:1, cone distances up to 4¼". Gears 20DP and finer may be ground directly from the solid; coarser pitches are ground after semi-finish cutting and hardening.

*Straight bevel gears with localized tooth bearing.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

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Inside Story of a

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES

Smart Buy for Your Shop . . .

It's a good idea to look "under the hood" when buying machine tools. Hidden features may give you some real clues to the machine's potential for your particular objectives. A quick look "under the hood" of CINCINNATI® ML and MI Milling Machines reveals a host of features that work unseen toward the common goal of every shop . . . to reduce the cost of production. Six features are illustrated below. Of course, there are many more, such as:

Automatic lubricating systems for column and knee reduce preventive maintenance

Knee and column oil filters may be removed from outside machine

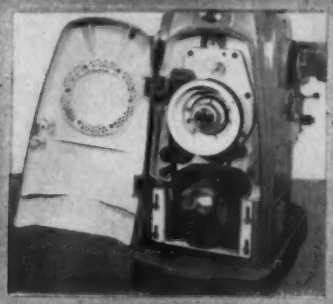
Hydraulic shifting of spindle drive gears gives the operator an assist

Live power rapid traverse at the rate of 150" per min. aids the setup man

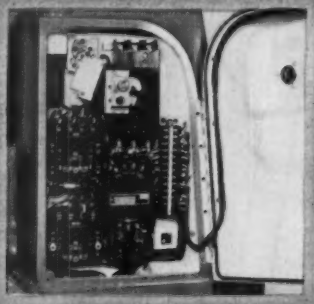
Big selection of standard attachments

CINCINNATI ML and MI Milling Machines are unquestionably a smart buy for your shop. Would you like to have more information about these machines? For brief data look in Sweet's Machine Tool File. Or, for complete specifications, write for a copy of catalog No. M-1916-1.

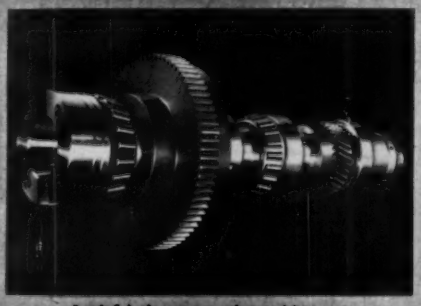
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Cradle type mounting for spindle drive motor greatly simplifies removal and servicing of the motor.

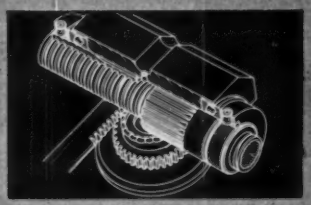


Electrical controls are built-in and completely enclosed for protection against accidental damage, dust and cutting fluid.

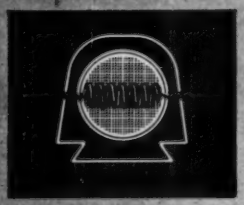


Anti-friction mounting with center support for the heavy spindle assembly, smoothly transmits maximum cutting power.

Vertical screw is submerged in a bath of oil from its own reservoir, assuring long, accurate life.



Automatic backlash device increases productivity. Machine can mill equally well as the table feeds to the right, left or alternately right and left.



Dynapoise overarm smooths out the cutting action; provides straight-edge alignment for arbor supports.

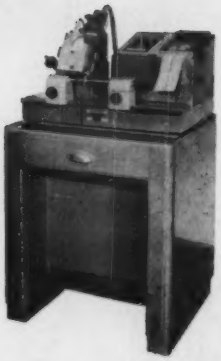
Brief Specs CINCINNATI ML and MI Milling Machines

Size	No. 2 ML		No. 2MI			No. 3MI	
Style	Plain	Univ.	Plain	Univ.	Vert.	Plain	Univ.
Range: Longitudinal	28"	28"	28"	28"	28"	34"	34"
Cross	10"	10"	10"	10"	12"	12"	12"
Vertical	16½"	16"	19"	18"	14"	20"	19"
Sixteen Spindle Speeds	25-1500 rpm all sizes and styles (higher and lower ranges optional)						
Sixteen Feeds	¼-30" per min., all sizes and styles						
Motor Drive: Spindle	3 hp	3 hp	5 hp	5 hp	5 hp	7½ hp	7½ hp

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

THIS RED LINE

"IN



Fellows Red Liner: Automatically makes and records a composite check of all gear errors in combination. Three capacities.

THE
PRECISION
LINE

helps to keep production

THE BLACK"!

The red line on a chart from a Fellows Gear Inspection Instrument gives accurate, large-scale indication of gear errors and their nature . . . keeps production costs down by minimizing rejects. And the permanent chart gives recorded *proof* that gears meet specifications in every respect.

Whether you're manufacturing tiny, fine-pitch gears or large, coarse-pitch ones, for your own products or for customers, it pays to rely on Fellows inspection instruments. For full information, get in touch with your Fellows Representative. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N.J.
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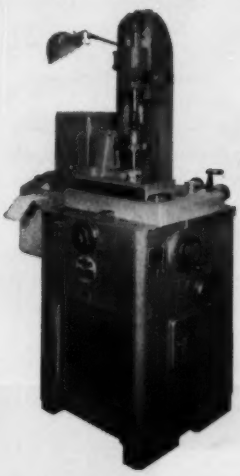
Fellows Lead Measuring Instrument: measures and electrically records the accuracy of helical and other surfaces; checks crown and taper. 12" and 24" P.D. capacities.



Fellows Involute Measuring Instrument: rapidly and easily checks involute profiles of external and internal spur and helical gears and records results. 12" and 24" P.D. capacities.

Fellows *Gear Production Equipment*

VAN NORMAN

No. 4BG1 Bowgage Production Grinder

10 Tons of Massive Rigidity

for Extra Precision, Performance and Economy in Mass Production Grinding

The No. 4BG1 Bowgage plunge cut grinder was developed for a leading automotive manufacturer for grinding pinion shafts. This 10 ton brute assures extreme accuracy and increased production by 50%.

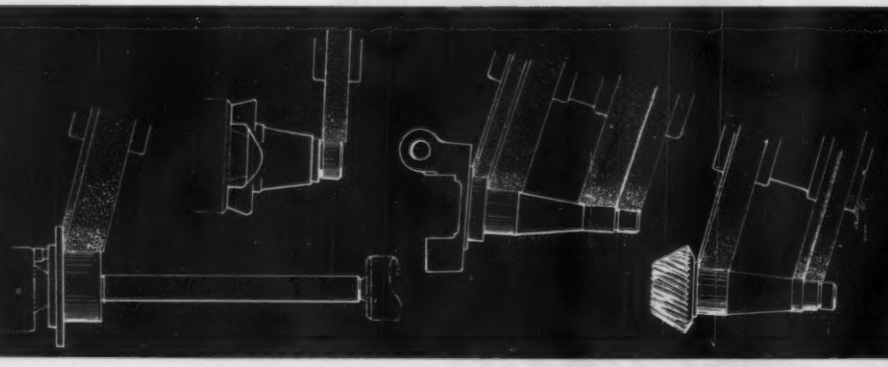
Van Norman production grinders feature the exclusive Van Norman Bowgage wheelheads.

These rugged heads are completely self-contained grinding units with feed-back gauging, size compensation, and exclusive diminishing feed, and automatic cycling. By simply taking one or more Bowgage wheelheads and mounting them on a suitable base, there is practically no limit to the number of diameters, tapers, shoulders, etc. that can be ground to close tolerances automatically. Automatic size control to .0002″ plus multiple step contour grinding can assist you to increase production, cut grinding costs. Formed dressed wheels can be profiled to accomplish step grinding for as many as 6 diameters at one time.

Specialized application in precision grinding for mass production can be designed into single or double head grinders to fit your particular requirements.

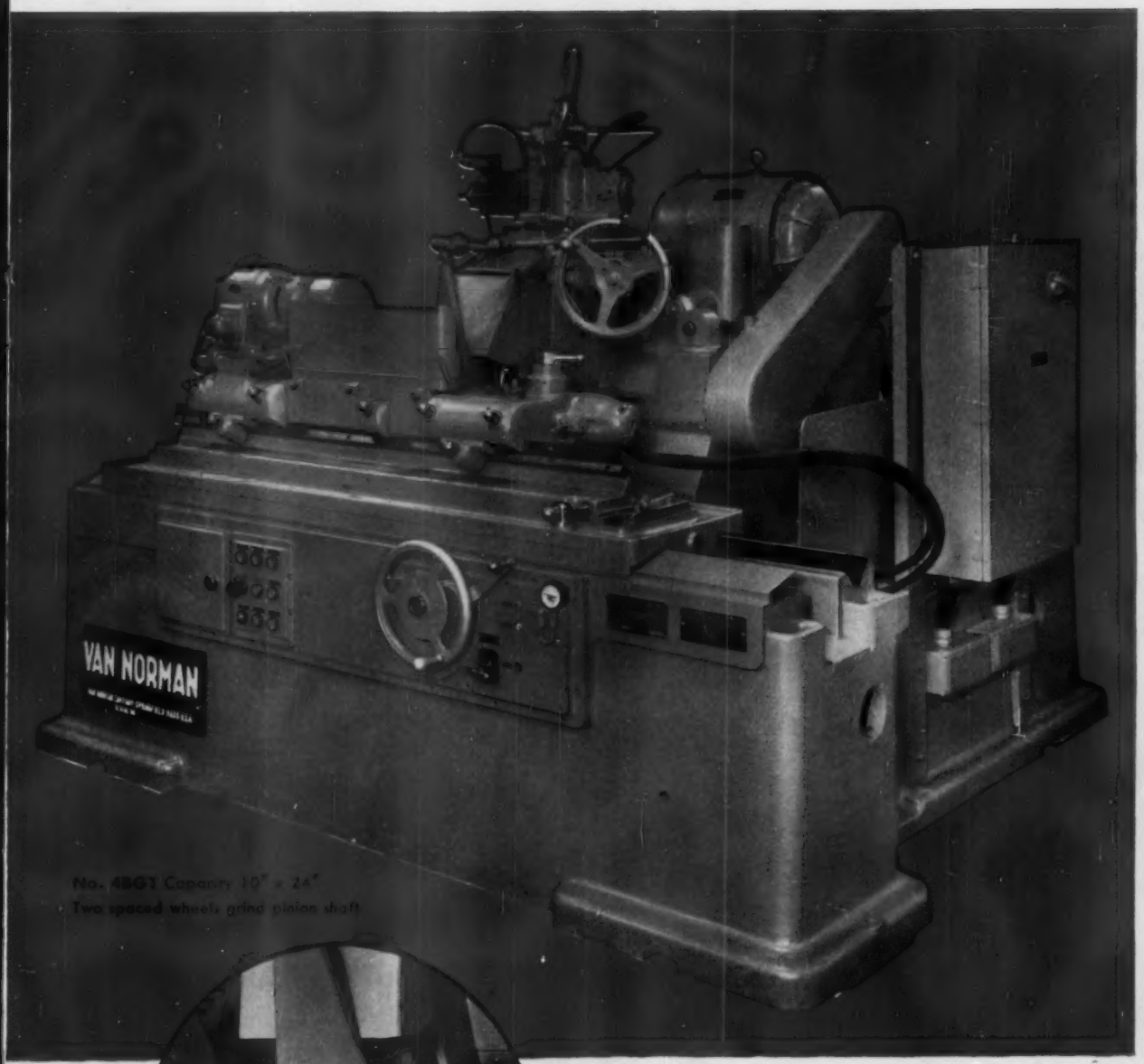
Write for catalog or engineering assistance.

Typical parts ground on the Van Norman single head Bowgage Plunge Cut Grinder.

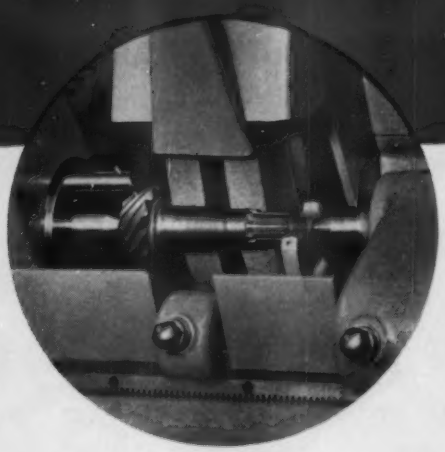


VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



No. 4BGT Capacity 10" x 24"
Two spaced wheels grind pinion shaft

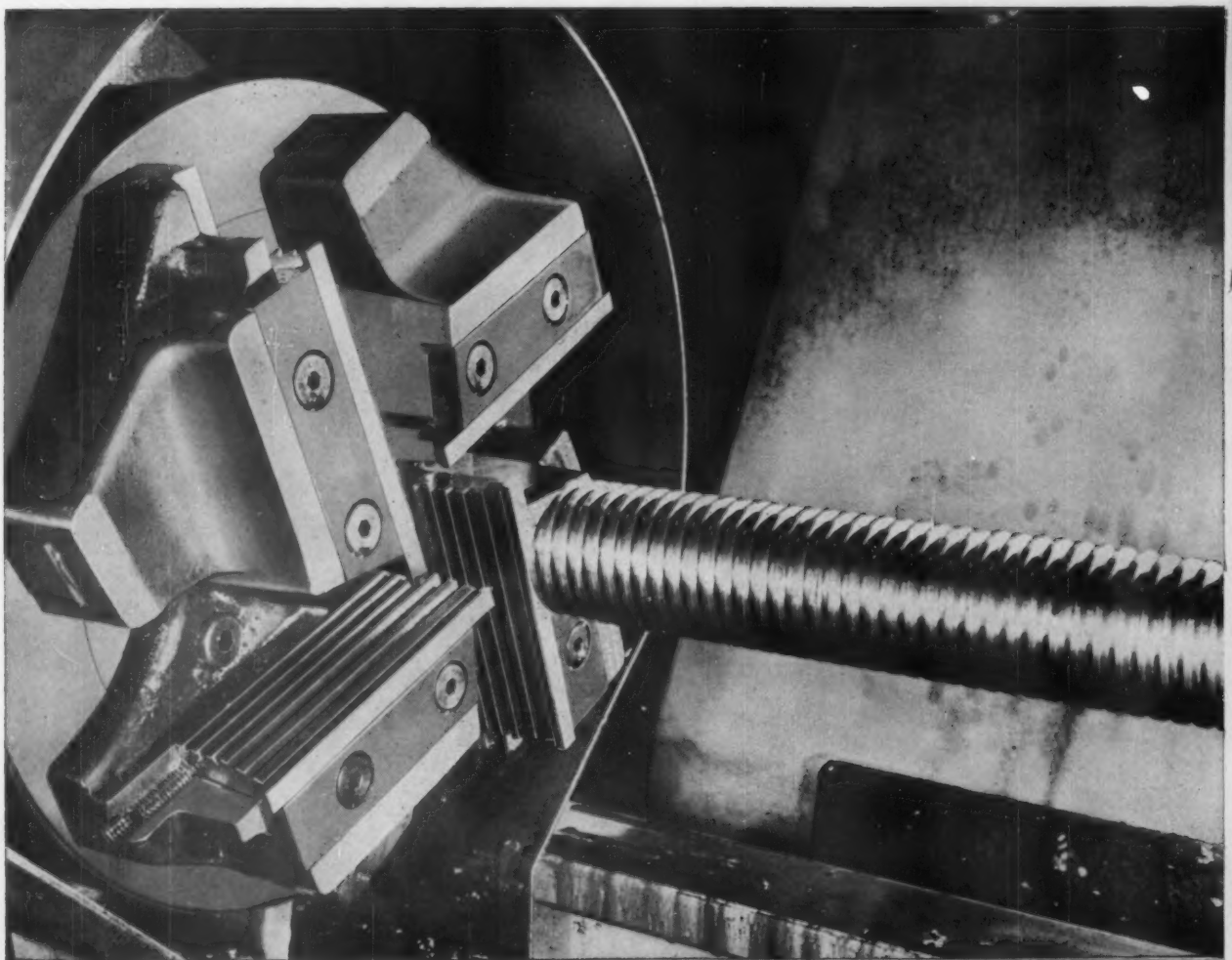


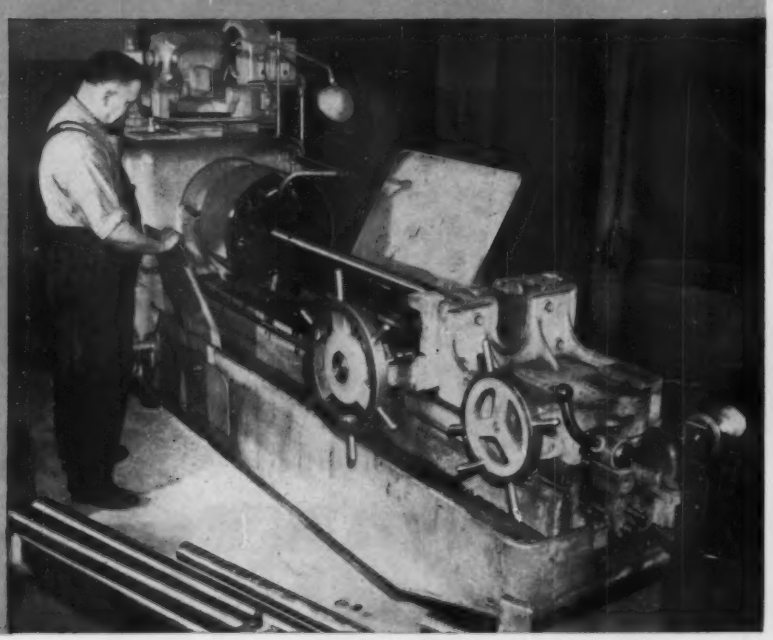
Don't wait . . . for extra profits install a Van Norman Machine now! They are available on many purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . up to 10 years . . . See your dealer or write Van Norman Machine Company.

Conditional Sales Contracts not available to Export.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS





90%

threading time saved

on power screws

This large saving in the production of power screws at Rodney Hunt Machine Co. (Orange, Mass.) was made possible by the use of a LANDMACO Threading Machine.

Specifications require 2¾" diameter—2½ pitch Acme threads 56" long on cold-rolled steel. 5 hours had previously been required to complete the thread. Floor-to-floor threading time was cut to only 30 minutes after the installation of a LANDMACO 32C Single-Spindle Machine with a special 60" carriage travel.

Many features in the design of this equipment make it possible to do heavy duty threading to precision tolerances. Heavy construction and leadscrew feed assure accurate threading. Slippage of the work is prevented by an improved carriage front with 60% greater gripping power.

Massive construction of the 4" LANCO head and chaser-holders give maximum support to the chasers for the largest or smallest diameters. The tangential design of the chasers provides lateral absorption of cutting strains and free cutting action. Their roughing-and-finishing form assures threads of excellent finish in one pass, and the centering throats eliminate the out-of-roundness common in long workpieces.

This is but one example of the production economies to be derived from using LANDIS Equipment on large diameter threading. For additional information, please send specifications and ask for Bulletin #*H-45*.

The World's Largest Manufacturer of Threading Equipment — Cutting - Tapping - Grinding - Rolling

LANDIS *Machine* COMPANY

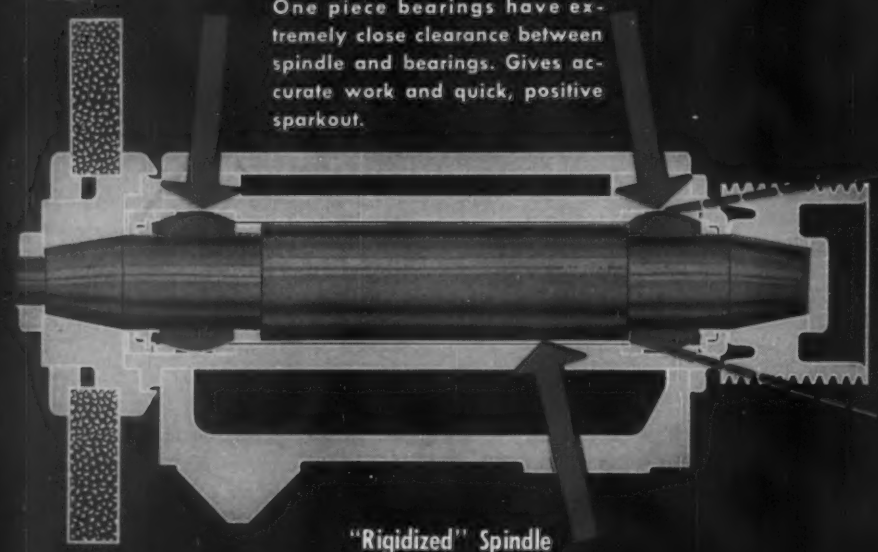
411-C WAYNESBORO • PENNSYLVANIA • U. S. A.

Only Landis grinders have "rigidized" bearings and spindles

for
- maximum production
- fine finishes
- high precision

"Rigidized" Microsphere Bearings

One piece bearings have extremely close clearance between spindle and bearings. Gives accurate work and quick, positive sparkout.



"Rigidized" Spindle

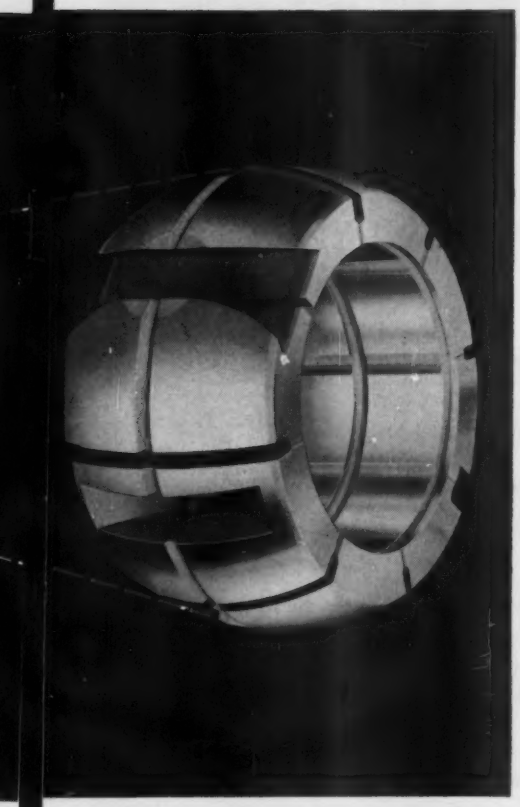
Because the diameter of the spindle between bearings is increased, you can take heavy cuts without loss of accuracy or finish.

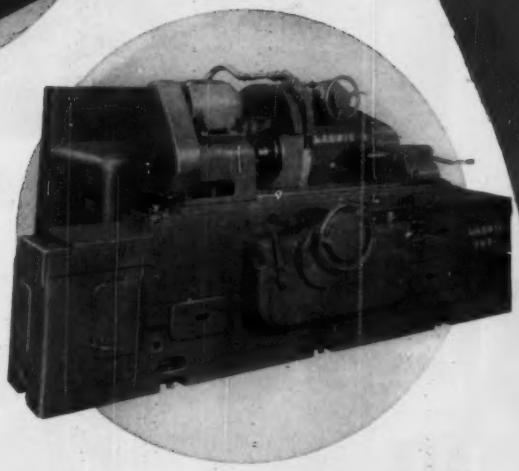
LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

Landis Universal Grinders have rigidized Microsphere bearings and spindle.

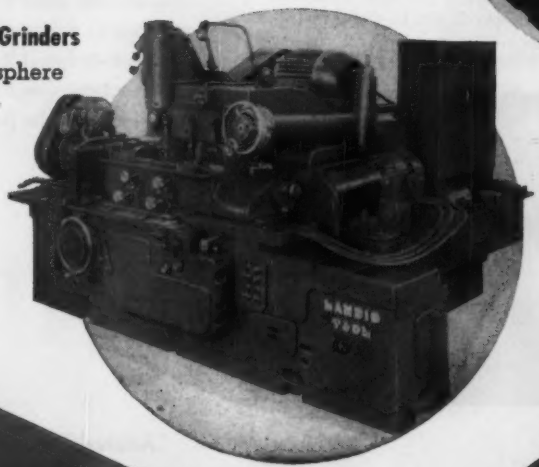




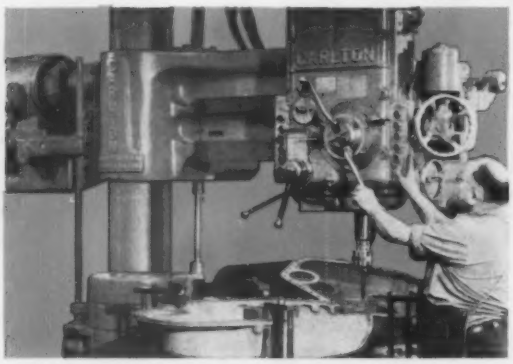
Landis Plain Grinders have rigidized Microsphere bearings and spindle.

Landis Centerless Grinders have rigidized Microsphere bearings and spindle in both the grinding wheel and regulating wheel heads.

Landis Single-Purpose Grinders have rigidized Microsphere bearings and spindle.



now take your choice of 4 different speed-feed controls



1 ***Manual*** 2 shifter levers for controlling speeds, 2 for controlling feeds.

2 ***Partial pre-selector*** 1 dial and 1 lever selects 36 spindle speeds. Feeds selected manually.

Programming pre-selects speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

Operator is free to concentrate on starting and stopping spindle, changing cutting tools . . . speeds and feeds having been pre-set.

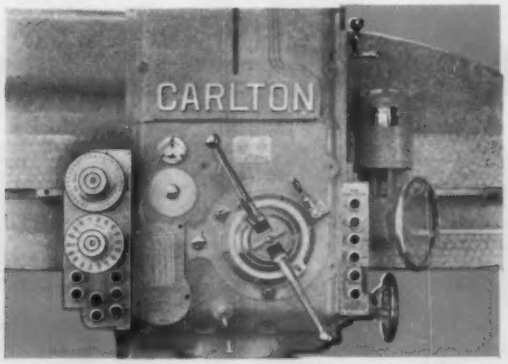
plan and pre-set speeds . . . with

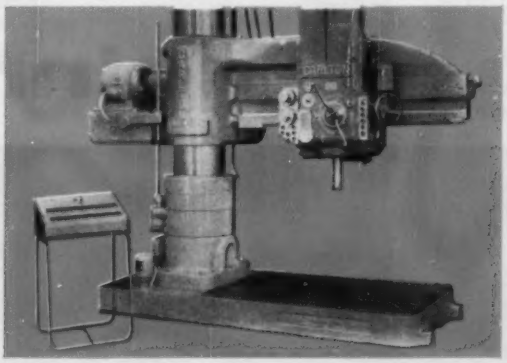
Carlton

Now you can choose exactly the right radial drill speed-feed control for your requirements . . . from among the four now offered exclusively by The Carlton Machine Tool Co.:

Programming: Here's how the Carlton-Leber programming works: your production engineering department studies the workpiece drawing and determines the sequence of drilling operations and the correct speed and feed for each. This data is recorded on a routing sheet or blueprint and is transferred to the programming console.

offered only by Carlton, specialists in radial drills





3 ***Pre-selector*** 2 graduated dials (one each for speeds and feeds) pre-set speeds and feeds.

4 ***Pre-selector and programming*** Sets up correct speeds and feeds for a complete sequence of operations.

and feeds for an entire drilling program

programming

The programming console contains an indexing dial which shows the operation sequence number being performed. Operator has local control and can perform operations out of sequence by manually advancing or reversing the indexing dial.

Pre-selector: For less lengthy or complicated drilling jobs, the programming unit can be disconnected through a selector switch and the pre-selector then becomes inoperative. The pre-selector saves time by allowing operator to select the speed and feed for the next operation while the machine is under cut.

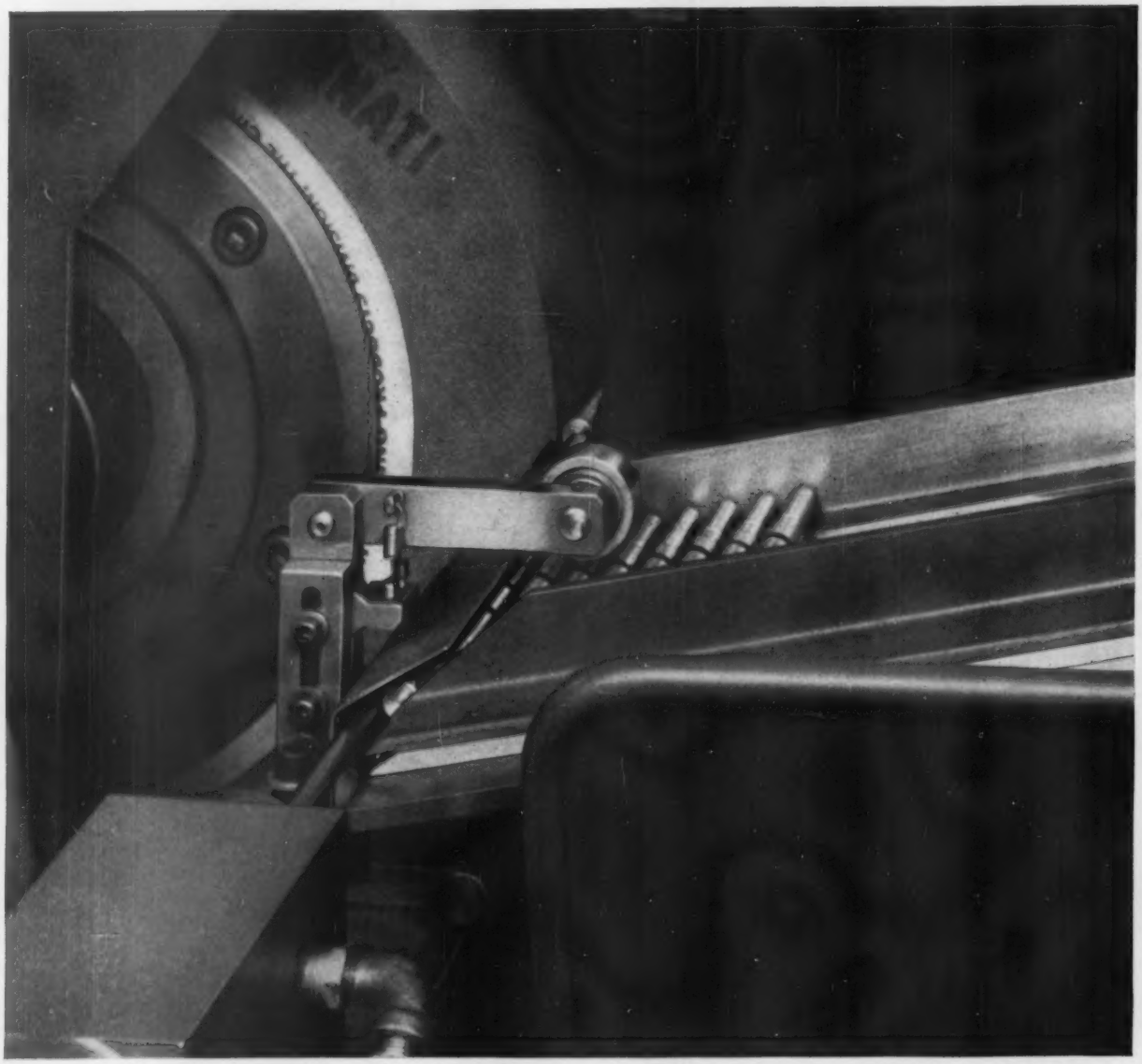
Partial Pre-selector: Pre-selects four different speed ranges and neutral. Nine speeds are selected manually in each range. Reduces by half the time required to shift over the manual method.

Manual gear shift also available.

It will pay you to re-evaluate your radial drilling operations. You'll find one of these Carlton controls will fit your requirements perfectly — and will help reduce your drilling costs. For complete information, send today for descriptive bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

Carlton *specialists in radial drills*

Cincinnati Filmatic



Five sizes of water pump shafts are automatically ground on the CINCINNATI FILMATIC No. 2 Centerless illustrated above. Tooling by Cincinnati includes an Electro-Hydraulic Automatic Infeed Attachment and magazine type work loading fixture arranged to handle five sizes of parts. The largest shaft is ground in two passes; one pass for the small shafts. Production: 240 per hour per pass at 80% efficiency.

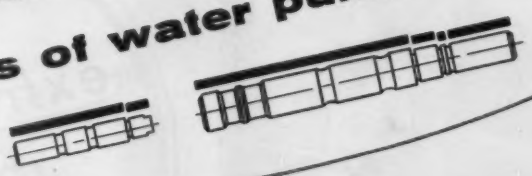
CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Nos. 0 2 3 4 5 6 Centerless

The No. 2 is the machine for this job

. . . automatically grinding five sizes of water pump shafts



FILMATIC

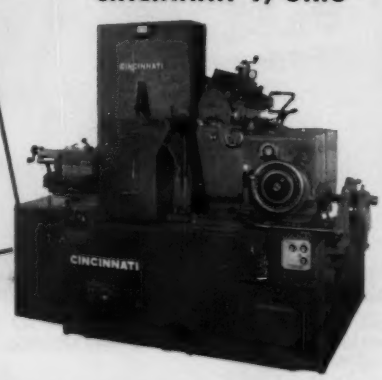
Multiple diameter jobs are "naturals" for CINCINNATI® FILMATIC Centerless Grinders . . . and for Cincinnati's 32 years' experience in centerless tooling. The illustration at the left shows how these two major elements of production — the right machine and the proper tooling — have been combined to reduce the cost of grinding five sizes of water pump shafts. ¶A CINCINNATI FILMATIC No. 2 was selected for the job. All diameters are centerless ground simultaneously; to close limits of accuracy; exactly concentric with each other.

The entire cycle, including loading and ejecting, proceeds automatically, at the rate of five parts per minute.

Much of the outstanding success of centerless grinding this part can be attributed to the machine. FILMATIC grinding wheel spindle bearings cannot deflect under wide infeed cuts; bed rock design for grinding wheel spindle housing withstands maximum hp metal removal; swivel mounting of regulating wheel pile simplifies setups; anti-friction infeed slide reduces maintenance and helps to maintain close tolerances. Want more information? Ask for catalog No. G-644-2. Brief specs for the entire Cincinnati Centerless line are in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

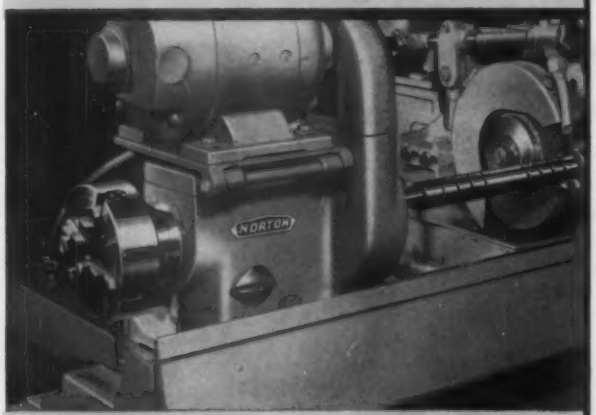
CINCINNATI FILMATIC
No. 2 CENTERLESS
GRINDING MACHINE
CATALOG No. G-644-2



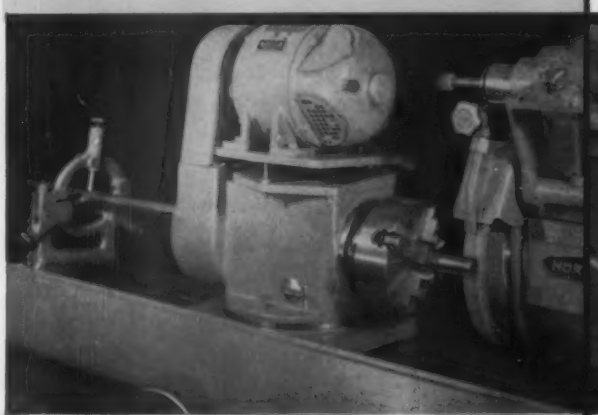
GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Norton builds extra versatility into universal grinders...

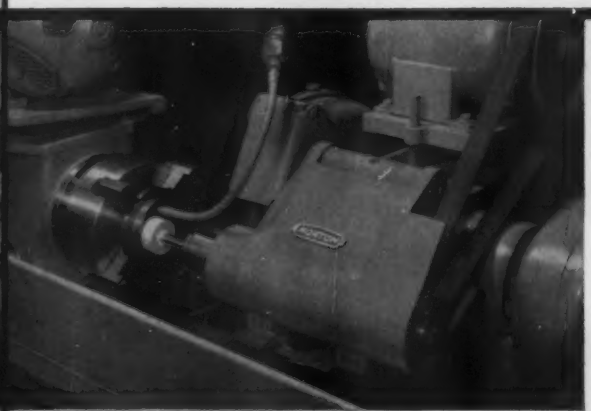
JOB-SPEEDING FEATURES



Minimum effort to change from dead center to chucking work. Chuck may remain mounted at back end of headstock while dead-center grinding.

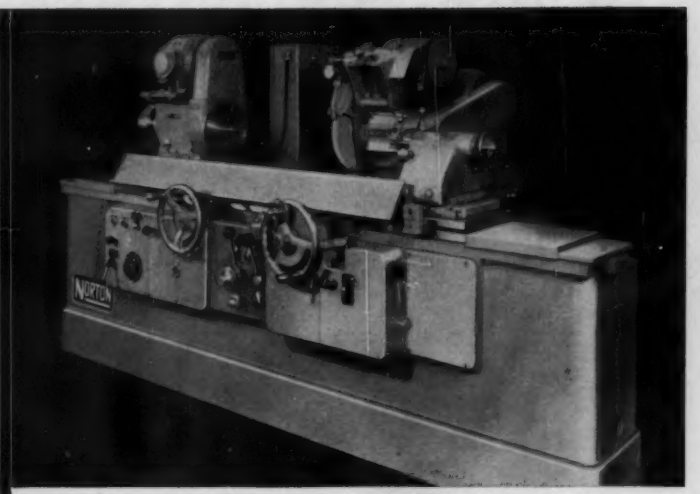


Hollow headstock spindle gives you additional capacity for grinding long bars by passing them clear through and supporting them in grinding position.



Hinged-bracket type internal grinding spindle swings up and out of the way when not in use. This means quicker setups for your I.D. or O.D. grinding.

Norton 10″ universal grinder. Made with 20″ or 24″ nominal lengths between centers. Catalog 170.



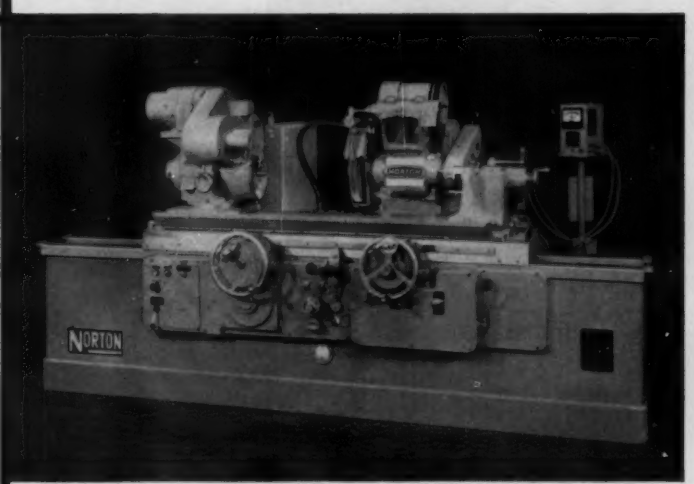
Norton 12″ Type U-4 universal grinder. Made with 36″ or 48″ nominal lengths between centers. Catalog 231.

Many a user rates his Norton universal grinder as a practically "complete grinding department." Why? Because Norton builds extra versatility into its universals for faster external, internal, face, taper and angular wheelside grinding, including many special jobs. Also they're built with many famous job-speeding, cost-cutting features: For example:

Extremely rapid chucking . . . quick change-over to live or dead spindle operation . . . easy work speed changes . . . independent wheel settings that do difficult jobs fast . . . extra capacities on wheel head and headstock . . . precise swivel table alignment with the SWIVALIGN *Dual Electric Indicator, an optional extra.*

Made In The Size You Need

Norton universal grinders are made in 10″, 12″, 14″ and 18″ swing capacities. That means you can get exactly the size to bring you many time-and-money-saving "Touch of Gold" advantages. For complete facts on these high-efficiency machines see your Norton representative or write us direct. And remember: Only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.



Norton 14″ Type U-4 universal grinder. Made with 36″, 48″ or 72″ nominal lengths between centers and also in 18″ swing capacity. SWIVALIGN* Dual Electric Indicator, at right of picture, measures swivel table adjustments and is optional on all Norton universal grinders. Catalog 819.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

THE

A B C

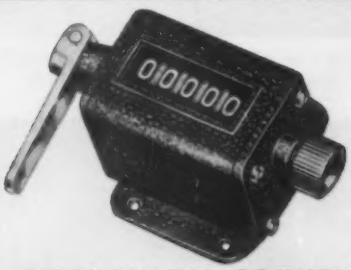
OF

1 2 3

Why is COUNTROL

important in every business today?

Countless times a day, every business needs to know "how many? . . . how much? . . . how far? . . ." and many other questions that can be answered only by facts-in-figures. But how to get these figures . . . from so many different machines, processes, operations and systems? Veeder-Root Counters are doing it every day, by means of:



MECHANICAL COUNTING

Small Resets count strokes, turns, or pieces . . . are used by thousands for moderate duty in parts inspection, quality control, conveyors, machine tools, light presses, etc.

HAND COUNTING

Where objects or units cannot be counted electrically or mechanically, hand-operated counters like this Hand Tally do the job. For instance, quick spot checks of production or performance, traffic count, inventory, etc. Fits palm of hand, counts one for each pressure of thumb lever, resets to zero by turning knob.

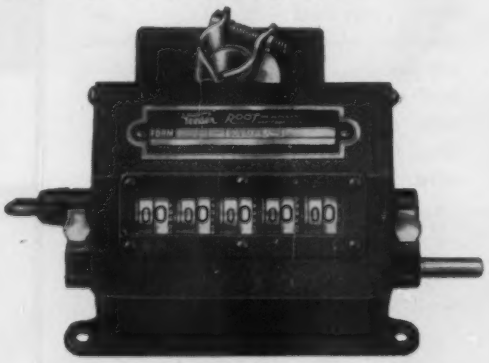
Insist on Standard

VEEDER-ROOT COUNTERS

from your Industrial Supply Distributor

ELECTRICAL COUNTING

These remote-indicating counters bring your production machines as close as your office wall. AC or DC, they can be connected in series with any simple switch, and will transmit production figures *instantly* over any distance. May be panel-mounted in groups.



CONTROLLING

Set it for the exact number of turns, pieces, or operations required . . . and this Predetermining Counter will control the run *exactly* . . . preventing over-runs and shortages. When the predetermined number is reached, counter will light a light, ring a bell, or actuate a stop-motion.

IN SUM: *If it can be counted or controlled . . . count on Veeder-Root to do it. Get in touch with your Industrial Supply Distributor for standard counters for application to your production machines and processes. And get in touch with Veeder-Root for counters to be built into original equipment.* **Veeder-Root Inc., Hartford 2, Connecticut.**

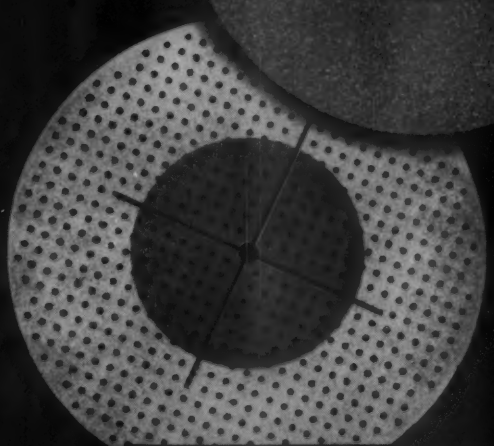
The right disc *surface* can *lower* your abrasive costs!

Deep corrugated for fast, cool cutting. small, medium and large corrugations

Smooth face for general purpose grinding: small areas, fine finishes

Two grades to maintain disc flatness on heavy shear cuts

Radial lines for better coolant distribution



Combination for special applications

there's a Gardner Disc Surface to fit every job . . .

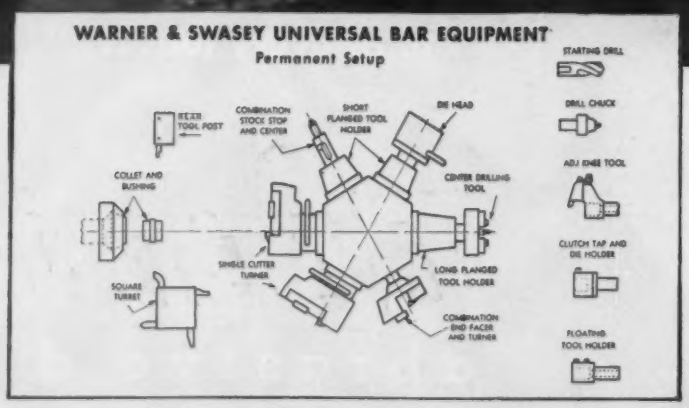
GARDNER

abrasive discs

BELOIT WISCONSIN

Here's a real case of

SMALL LOT



Warner & Swasey Standard Tools are quickly interchangeable for simple or complex jobs—in large or small lots—thus minimizing your tooling costs.

PRODUCTION

on No. 3 turret lathes at CAMCO, INC.

CAMCO MACHINES A WIDE VARIETY OF PARTS LIKE THESE IN 6 TO 100 PIECE LOTS

CAMCO, INC., Houston, Texas, depends on Warner & Swaseys for small lot production of parts for their gas lift valves—equipment which lifts petroleum from oil wells whose natural forces are exhausted.

Two of these nine Warner & Swaseys are standard tooled No. 3 turret lathes which machine a wide variety of simple to complex parts from stainless steel and monel metal, in lots averaging 50 pieces. Tolerances as low as .002 are held on most jobs.

One of the No. 3's is also equipped with a full length lead screw and selective gear box to machine numerous small lot threading jobs. The threads are chased with the lead screw and an automatic knock-off attachment. Specification of the threads: standard vee or round form, special diameter, standard pitches, Class 3.

Since the day the first No. 3 machine was installed in 1954, working two 9-hour shifts per day, not one hour has been lost because of downtime for repairs! Similar performance has been achieved by their other Warner & Swaseys—No. 4 and No. 5 turret lathes, 2-A and 4-A heavy duty turret lathes, and two 5-spindle automatics.

This story again illustrates a point recognized in our customers' plants throughout the world—for dependable day-after-day production of small lots, you can't beat the versatility and accuracy of standard tooled Warner & Swasey Machine Tools!

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

LeBlond customers report:

New REGAL lathe design

Recommended by machine shop operators

P.S. I also have another one on order.

more for my money

Best Tool Room lathe I have used in the past 14 years, also Best Lathe for the money.

it is the best lathe I have found in 35 years experience

I liked the looks and the Rigidity.

scores high with operators

"Satisfied" or "well pleased" report 95% of new Regal operators! Source of these figures is the LeBlond Use-Check Questionnaire, which we send to all new LeBlond lathe owners—a direct method of learning what industry wants, needs, likes (or dislikes) in its lathes. Actually, the new Regal Lathe is designed largely around suggestions and ideas expressed by our customers in Use-Check Questionnaires of recent years.

What do the owners say about the new Regal?

Best-liked Regal features proved to be hardened bedways, electric brake and the speed range. 73% of the new Regals are being used in the toolroom or on the production line. Here's how some of the other questions and answers ran:

Q. "*Is production rate what you expected?*"
A. "Satisfactory or better" (96%).
Q. "*accuracy?*"
A. "Satisfactory or better" (97%).
Q. "*finish?*"
A. "Satisfactory or better" (96%).
Q. "*convenience?*"
A. "Satisfactory or better" (93%).
Q. "*Why did you select a LeBlond?*"
A. "Best dollar value." "Previous experience" (two biggest reasons).

At left are some of our customers' comments in their own handwriting.

The reason for this overwhelming acceptance of the new LeBlond Regal can be summed up very simply. It is what industry has been asking for—performance-wise, feature-wise, price-wise. Your LeBlond Distributor will give you all the details. Call him today, or write.

. . . cut with confidence

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

Designed and built like heavy-duty lathes, the new LeBlond Regals will give you a long life of precision production, minimum maintenance and the kind of dependability you'd expect from a much higher-priced machine!

The new Regal headstock uses the same combination gear-belt drive construction that proved itself on the famous LeBlond Dual-Drive and is now incorporated on our new 16" heavy-duty lathe. The new bed has hardened and ground replaceable steel ways like the ways on our heavy-duty machines. They are fitted according to the compensating veeway principle to insure better distribution of forces for proven long-time accuracy and minimum wear.

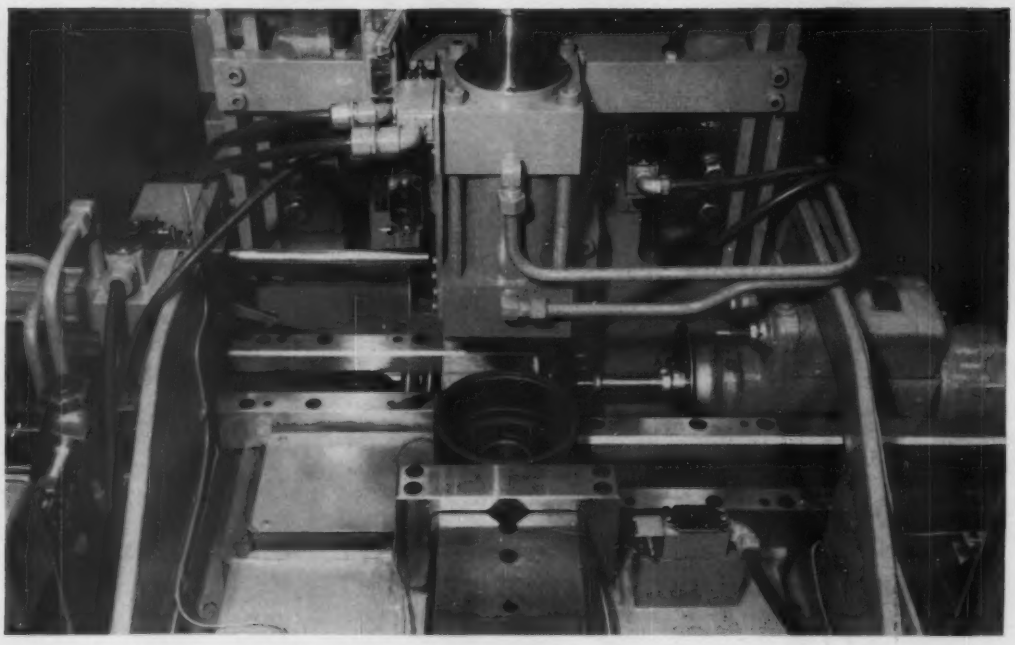
Again, like higher-priced lathes, Regals are equipped with both feed rod and leadscrew for continued accuracy in thread chasing. Other big-lathe features — 3-bearing spindle. Automatically-lubricated quick-change box. Wide carriage bridge with ample bearing surface. Rugged tailstock with plug clamping. Plus general dimensions and construction details patterned after LeBlond heavy-duty lathes.

All of LeBlond's 70 years of experience has gone into the design and building of these new Regals. Only from the builder of a complete line of lathes can you get a low-priced lathe with big-lathe features.

World's Largest Builder of A Complete Line of Lathes for More Than 70 Years

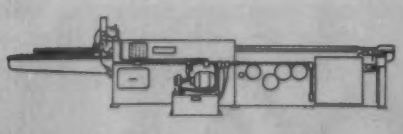
2 OPERATIONS: BROACHING
DRILLING
performed on this 5-ton LAPOINTE BROACHING MACHINE

. . . automatically, . . . fast, . . . without error!

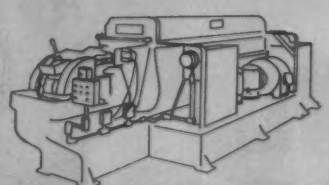


Lapointe-designed-and-built Fixtures are always practical. They should be, for they embody the best in broaching experience over a 55-year span. This one is fully automatic, and permits *no possible error* in broaching the keyway and drilling the oil hole in the front brake drum shown here. Location is *fixed*, both operations are performed without moving the part. The broach used is the fabricated type, with replaceable broach inserts and hardened pulling arbor.

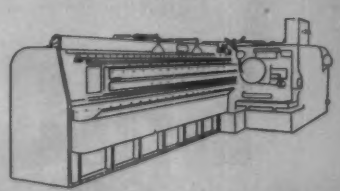
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



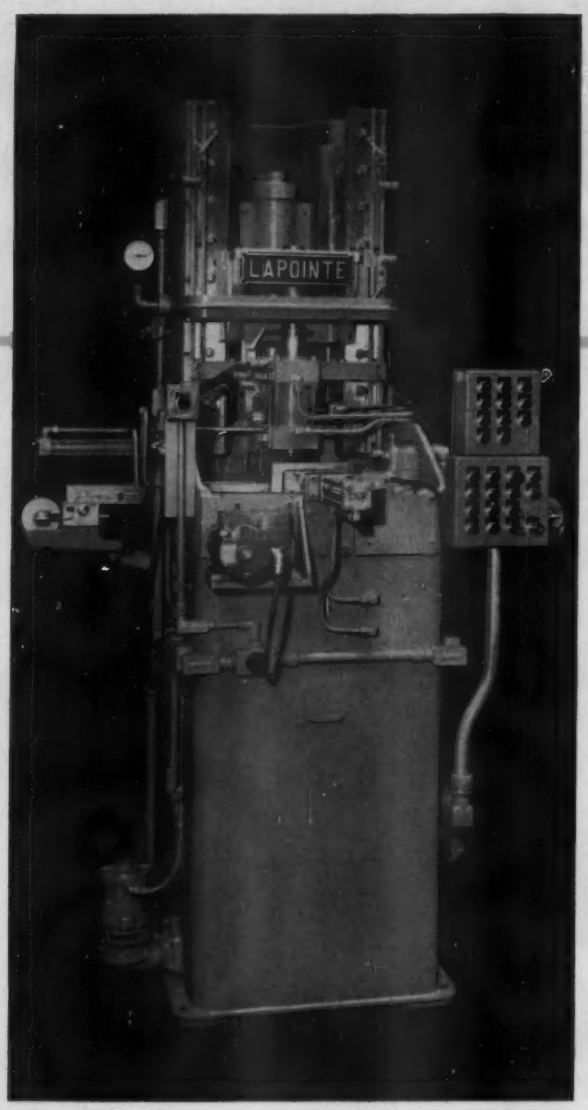
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC



This looks like "efficiency-*plus*" — and it is! It's the 5-ton Lapointe V-1 Vertical Pull Down Broaching Machine, with 36-inch stroke, special fixtures, and automatic parts handling equipment. A completely integrated unit, electrically interlocked for safe operation.

Let automation help you to decide!

When you can combine broaching and drilling on the same machine (and a *small* broaching machine, at that!) you are letting automation help you decide to *convert to Lapointe-Broaching.*

And that's not a bad idea, converting to Lapointe-Broaching! Here's how two operations on a front brake drum are efficiently and economically performed in a very large automotive plant:

a) Part is moved from belt conveyor into broaching position

b) Keyway is broached

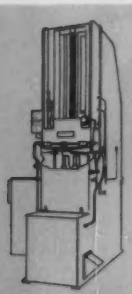
c) Without moving the part, the 1/16" diameter hole is drilled *central with keyway*

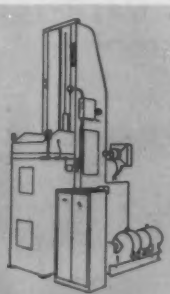
d) Part is ejected onto unloading chute

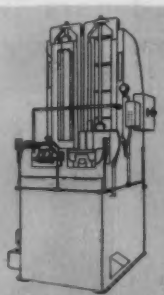
Producing 150 parts per hour, everything completely automatic and with no possibility of error or scrap, *how could you possibly improve on this!* We believe it will be to your advantage to discuss some of your own troublesome, costly metal-removing problems with a Lapointe Field Engineer.

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES


VUE-7 VERTICAL FULL-UP ELECTRIC


SRVE SINGLE RAM VERTICAL, ELECTRIC


DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE
known to be the best in
BROACHING

the latest word in low cost machining

televersal

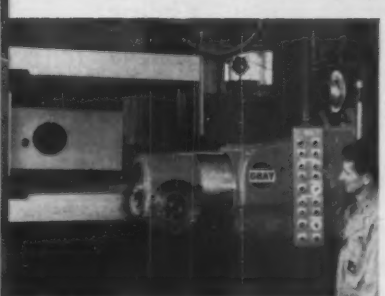
This new GRAY TELEVERSAL head tremendously increases machining range. Conveniently applied, quickly positioned, its great rigidity permits highest horsepower milling cuts.

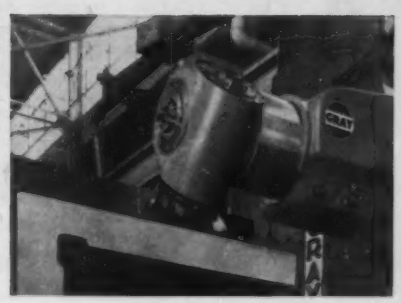
The large diameter quill may be swiveled to permit any angular cut. A triple-straddle clamp inflexibly locks the quill to the cast pyramid body.

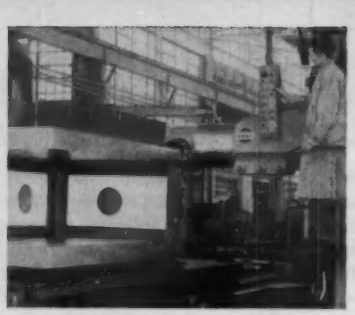
Designed to keep the job low and yet permit great machining range. Ideal when used with column cross travel of the new GRAY horizontal, boring, drilling and milling machine.

Not just an attachment, but a high power massively built, heavy milling unit that offers a new concept in versatility.

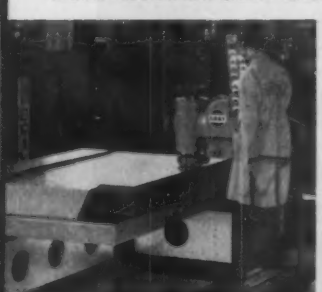
The G. A. GRAY Co., Cincinnati, Ohio

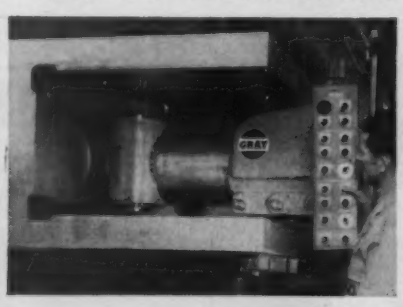


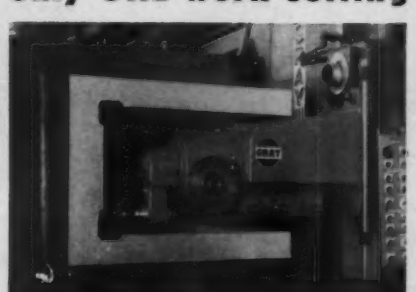


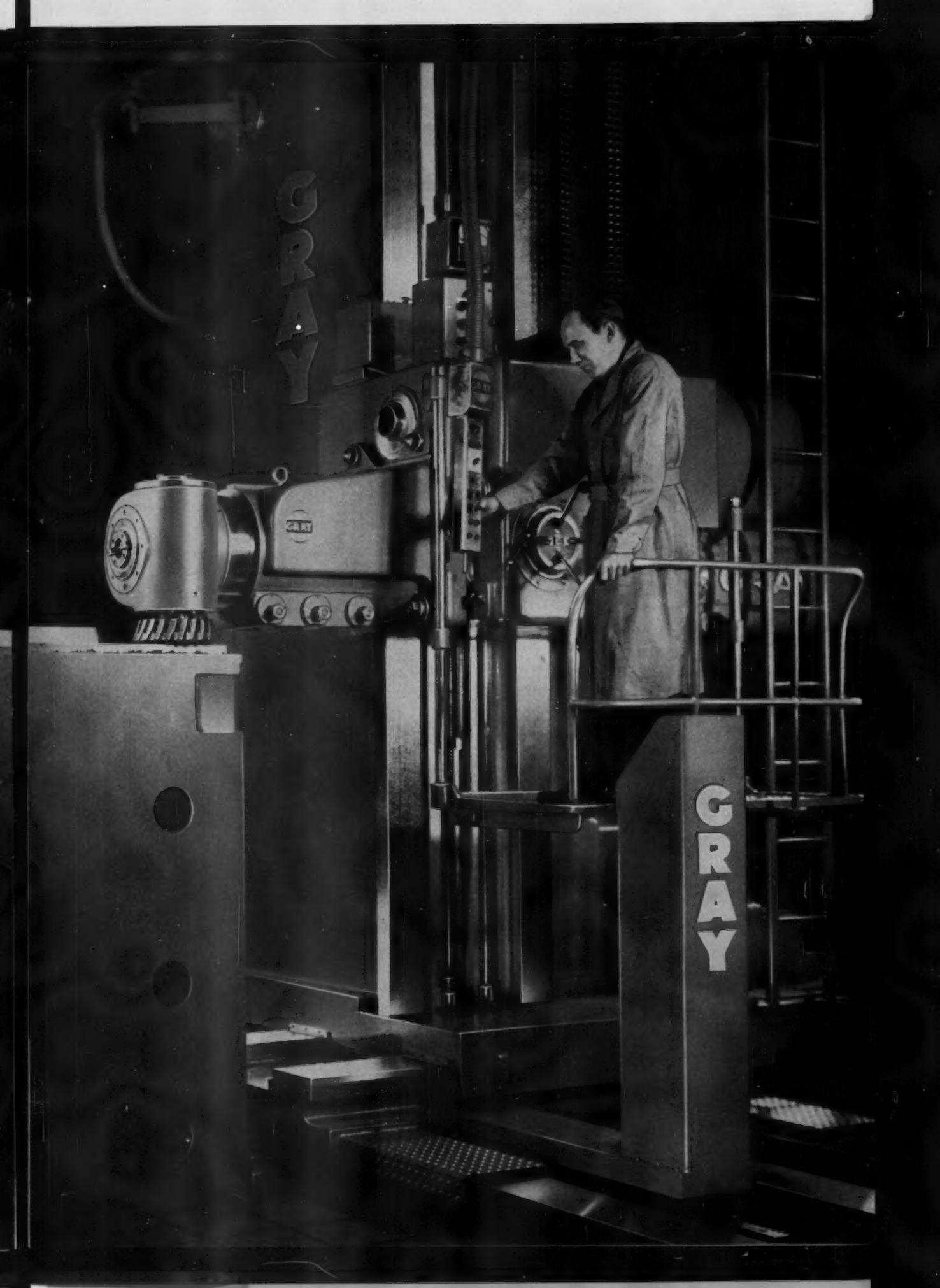


six different surfaces and more ... and only ONE work-setting

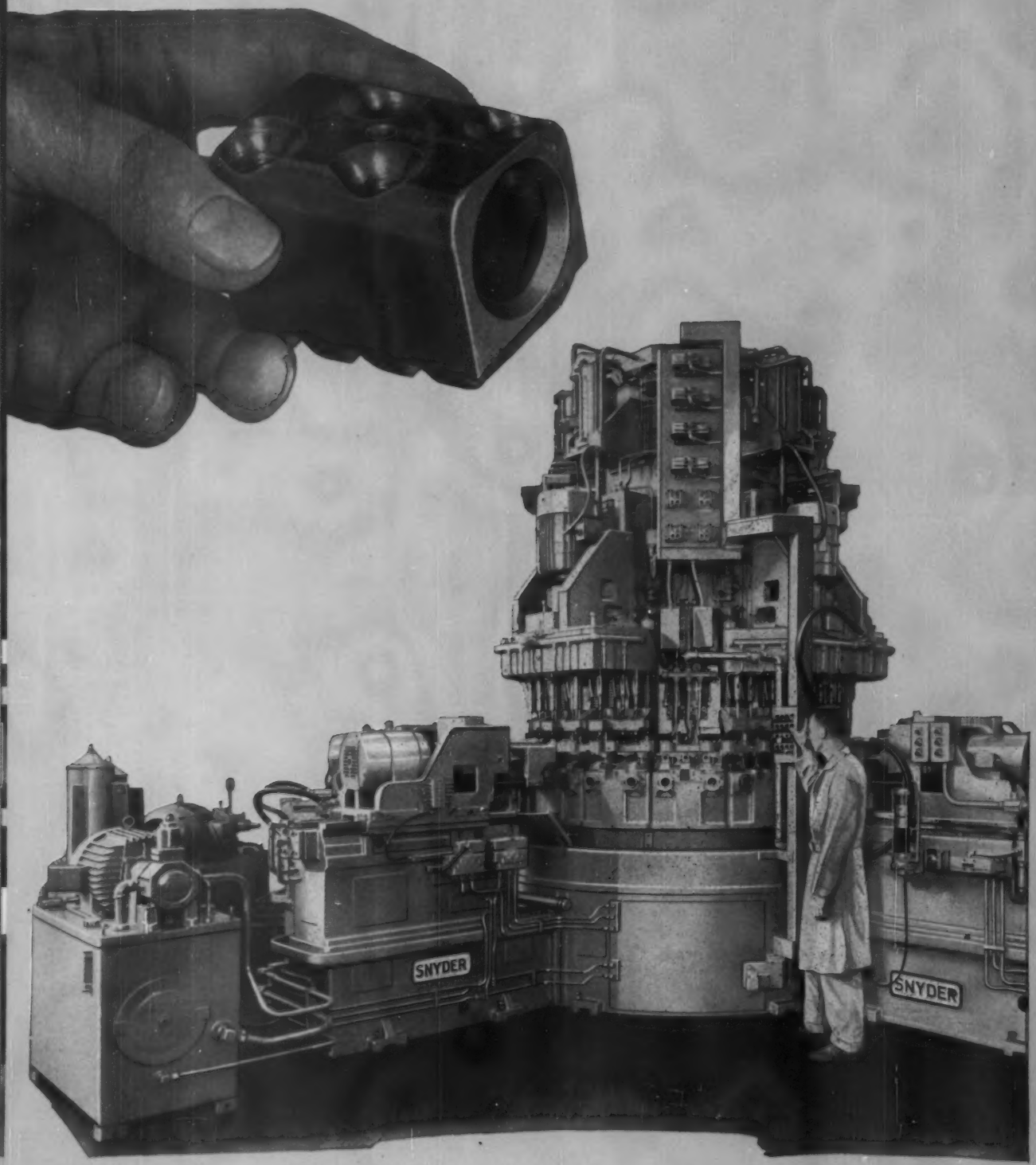







GRAY
GRAY
GRAY

Simplified Automation in
Successfully Applied in New



Machining Small Parts is Snyder Center Column Machine

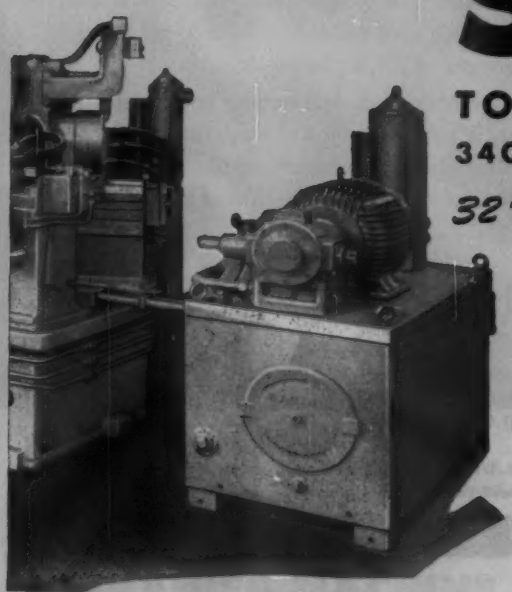
The principle of automation is inherent in the design of this machine which performs, in its continuous 16-station cycle, 25 operations equalling the performance of two or three ordinary machines. The workpiece is a small automotive steering gear ball nut 2½" x 1⅝" x 1⅞". Production is 331 pieces per hour.

Three workpieces are loaded and automatically clamped in each of the 16 fixtures on the 96" index table. A unique feature of the machine is its special heavy-duty cast iron center column 108" high and 48" in diameter. This massive column is necessary to withstand the high vertical thrust loads imposed by six heads mounting 9 spindles each which drill, flat bottom drill and radius chamfer four recirculating ball holes and tap drill and chamfer one hole in the same part face.

The table is also designed to withstand high horizontal thrust loads for core drilling, chamfering and reaming the threaded shaft hole which requires three spindles for each of the seven Snyder heavy-duty way type units.

The machine, one of the largest of its type, weighs 50,000 lbs., requires 288" x 312" floor space and stands 156" high overall.

If you have an automation problem in machining small parts, this type of Snyder machine may be the right answer.



SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

"World's largest fabricator of freight car parts" uses USS Galvanized Steel Sheets!

Standard Railway Equipment Manufacturing Company of Hammond, Indiana, manufacturer of specialty parts for freight cars, has made wide use of USS Galvanized Steel Sheets for many years. In the accompanying pictures, USS Galvanized Steel Sheets are being formed into freight car roof sheets. The deep corrugations have added strength and rigidity.

USS Galvanized Steel Sheets have the physical properties to stand up under the rigid forming requirements necessary to the production of roofs for box and refrigerator cars, cabooses, covered hopper cars, and component parts. USS Galvanized Steel Sheets have an even coat of zinc, and can be cut, stamped, rolled, spot-welded, soldered, or formed without danger of flaking or peeling.

If you use galvanized steel in your manufacturing operations, it will pay you to investigate USS Galvanized Steel Sheets. For more details, get in touch with a District Sales Office of United States Steel.

USS GALVANIZED STEEL SHEETS

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

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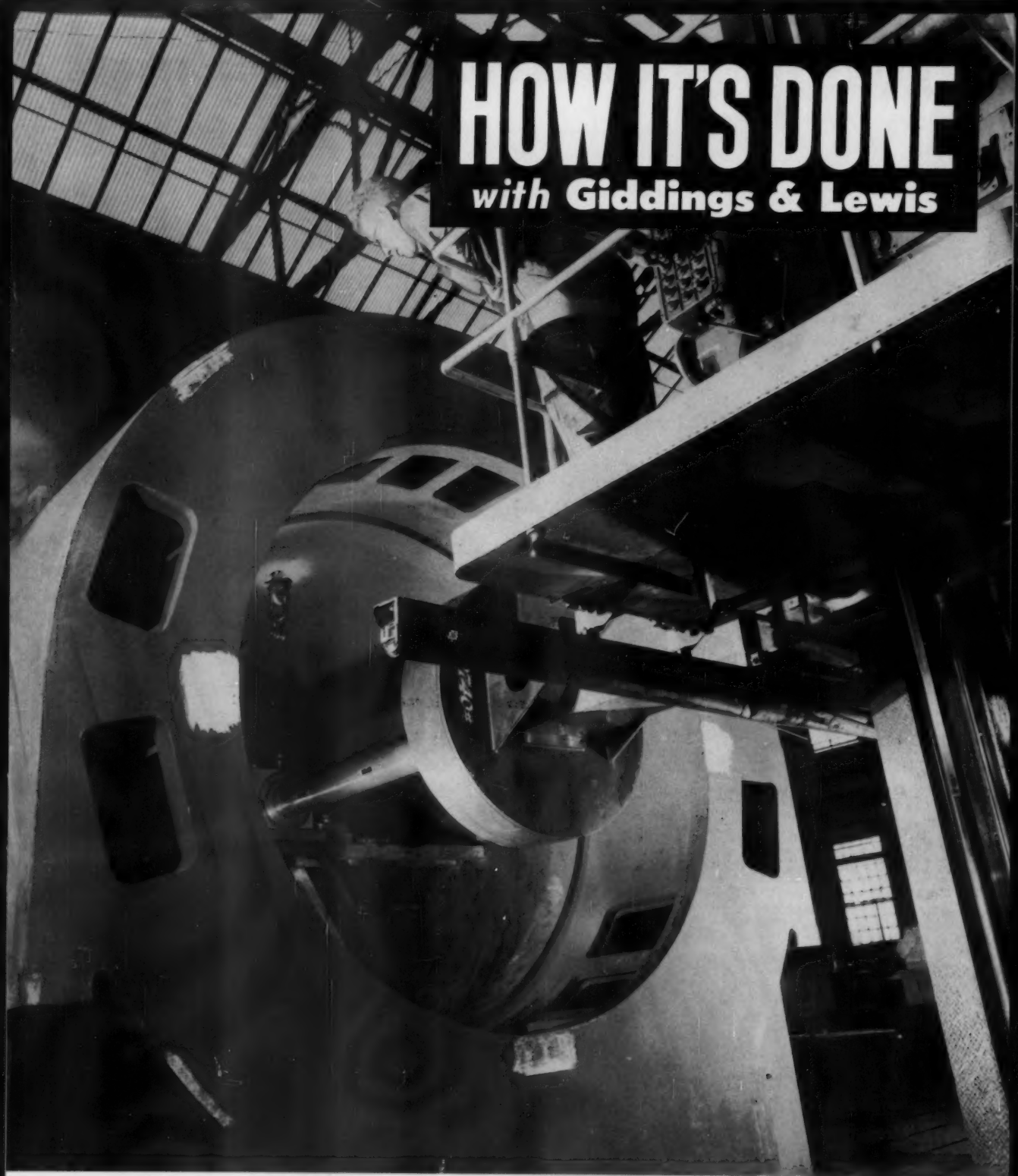
UNITED STATES STEEL

HOW IT'S DONE
with Giddings & Lewis



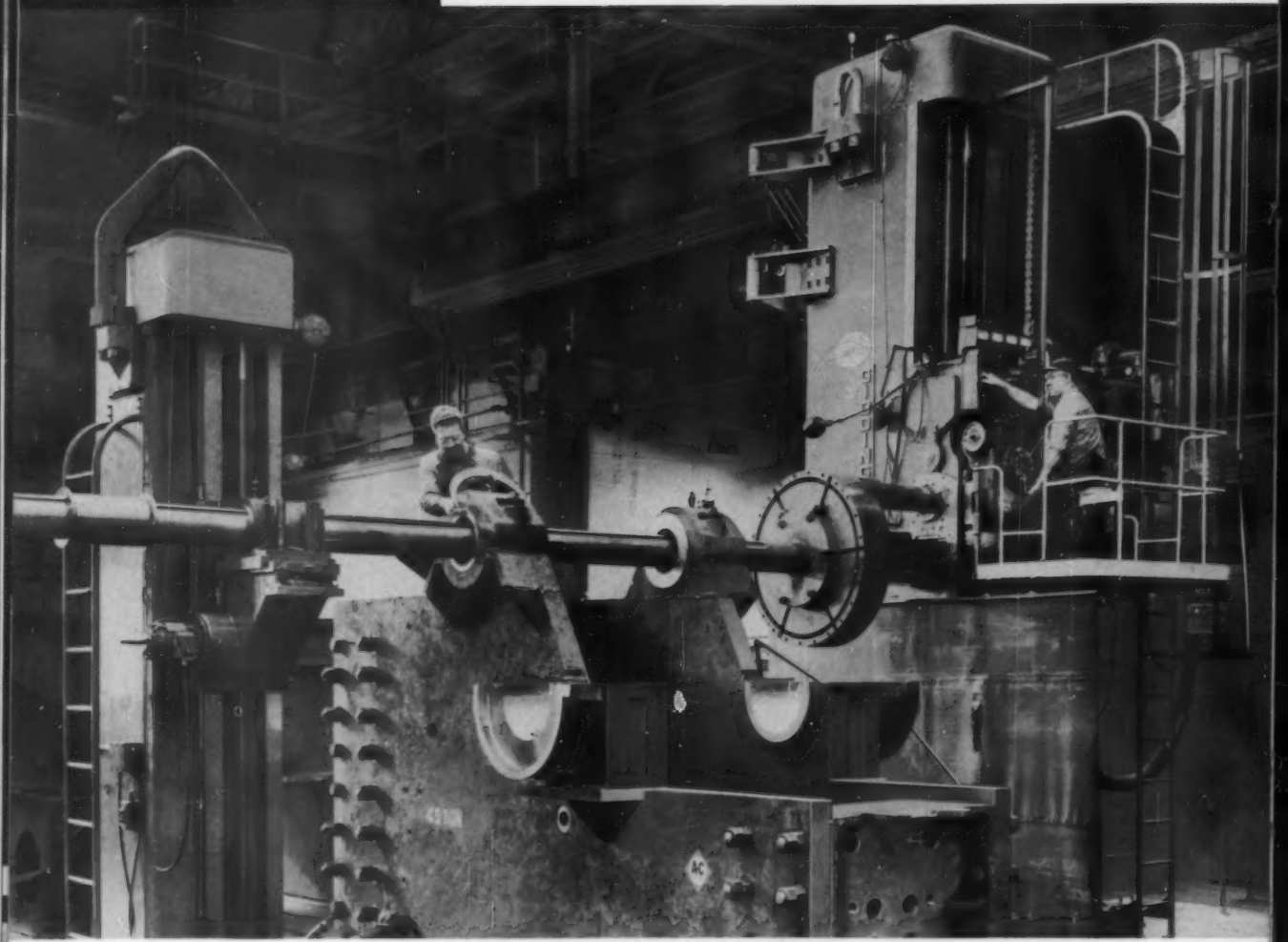
Giddings & Lewis Model-FUAR (floor-type) horizontal boring, drilling and milling machine performs straight-through line boring on stator yoke for a large fully supercharged conductor-cooled generator at Allis-Chalmers Mfg. Co., Milwaukee, Wis. This operation utilizes the G&L face plate drive attachment, mounted on the underarm.

ACTUAL CASE STUDIES SHOW HOW SEVEN COMPANIES MACHINE FOR PROFIT

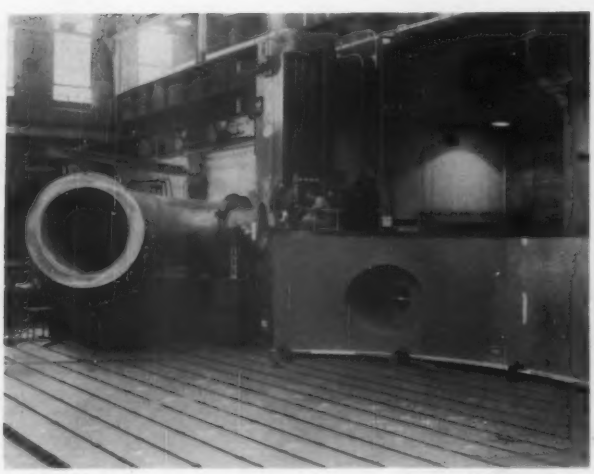
. . . ideas that may trigger new cost-cutting and production methods for you

HOW IT'S DONE
with **Giddings & Lewis**

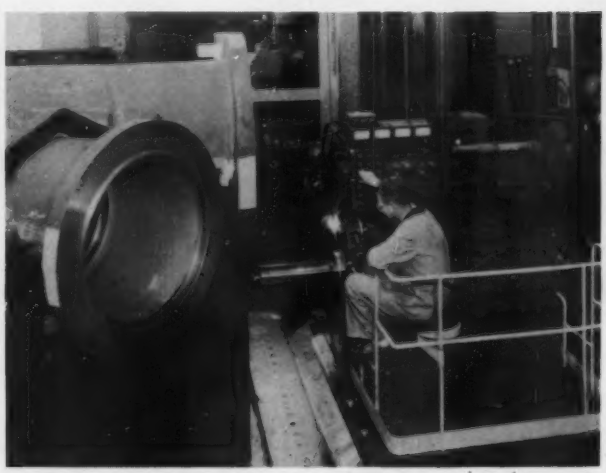
Model 570-FUAR horizontal



Bearing surfaces, flanges and caps on this 45-ton crusher frame — 15'-10" long, 8' high to centerline of upper bearing and 8½' at widest point—are rough and finish bored and faced. Other precision operations include grooving and counterboring.



Here's proof of Model 570-FUAR's versatility. The 20-ton hydraulic turbine spiral casing section and large pit liner are set up on same floor plate. After flange on spiral casing is face-milled, operator moves machine to pit liner for precision boring and facing operations.



Giddings & Lewis Model 570-FUAR horizontal boring, drilling and milling machine, rough and finish turns, faces and grooves four nozzles on this 20-ton hydraulic turbine casing. Here a 76" O.D. x 57" I.D. flange is finish-milled with a 6" face mill cutter.

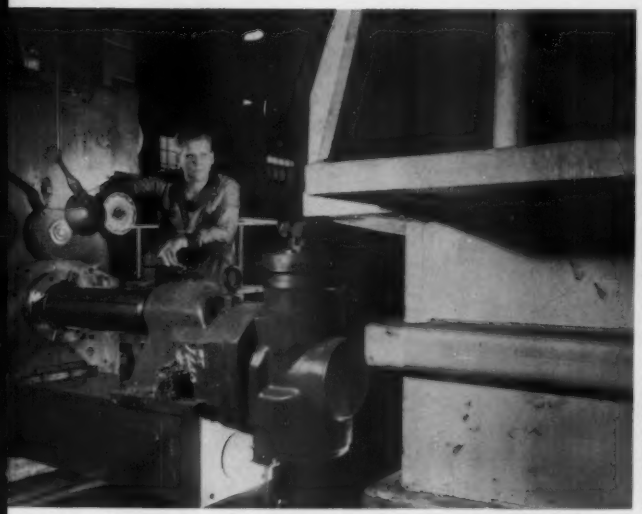
proves productive capacity at Allis-Chalmers

Giddings & Lewis versatile horizontal precision faces, bores, turns, mills and counterbores various surfaces on hydraulic spiral casings . . . steam turbine exhaust casings . . . giant generator yokes . . . swing jaw crusher frames

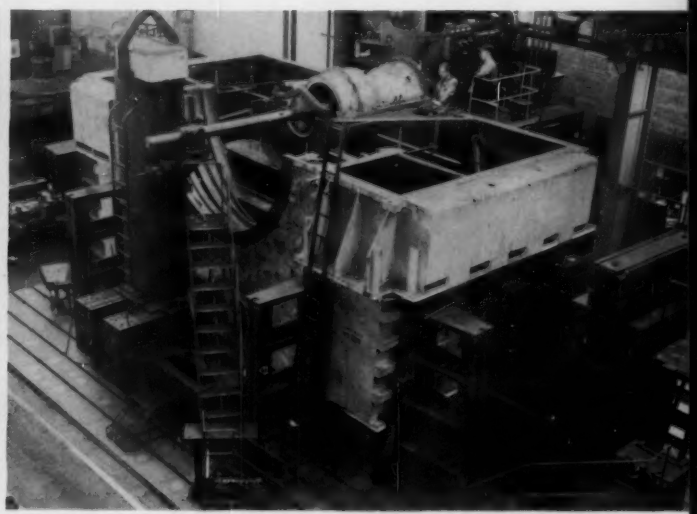
Giddings & Lewis (floor-type) horizontal boring, drilling and milling machine with 7" dia. spindle and a heavy-duty underarm is a busy machine at Allis-Chalmers, Milwaukee, Wis. Equipped with profit-making accessories — 48" continuous feed facing head, 90° angular milling attachment and 46" face plate drive, Davis boring bars and cutters — the Model 570-FUAR is kept busy three shifts per day!

For example: 20-ton hydraulic turbine casing flanges are face-milled at 250 sfm and 20 ipm feed. The 20-foot-long casing measures 76" O.D. x 57" I.D.

The rugged G&L machine precision bores a huge 70-ton stator yoke — 24'-4" long, 13'-2¼" high and 13'-3" wide. Operations include boring 104.712" dia. inner rings (plus .005", minus .000") — facing the ends (plus or minus 1/32" overall) and milling the cooler openings. Another important job is finish boring and facing massive 40-ton swing jaw crusher frames. Besides all this, versatile horizontal performs a variety of machining operations on other castings and weldments.



The 90° angular milling attachment, mounted on heavy-duty underarm, makes possible milling of base flange on low-pressure turbine exhaust casing for a large steam turbine.



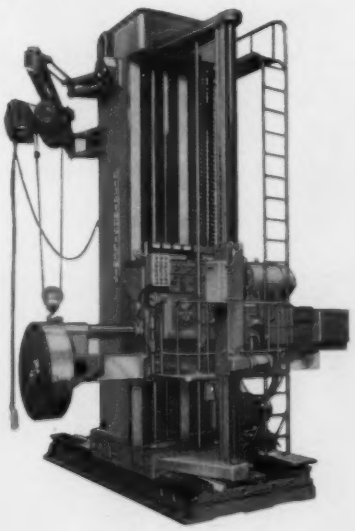
One of the largest weldments to be line-bored and faced is this 95-ton lower half section of welded plate steel casing for one of world's largest steam turbine generator units.

Time-saving optional accessories promote versatility

Giddings & Lewis 50 Series horizontal boring, drilling and milling machines are available with 6" and 7" dia. spindles . . . wide range of speeds and feeds . . . 40-75 hp. They're offered with G&L's *Dupli-Tracer* control and other time-saving accessories such as:

★ Power hoist, mounted integrally with the machine column, facilitates handling and setting up of heavy accessories.

★ Built-in elevator on machine's column enables operator to select the most ideal working position in relation to the headstock and work. Elevator operates independently of the machine headstock.



G & L *and* HYPRO DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO.

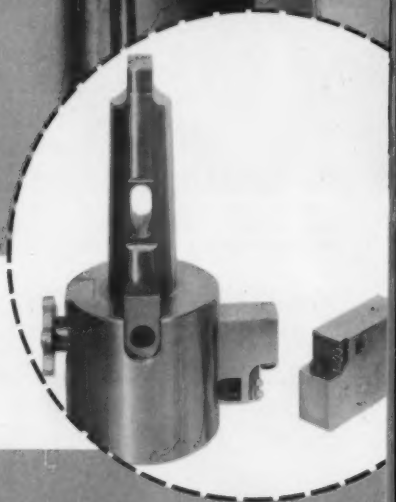
FOND DU LAC, WISCONSIN

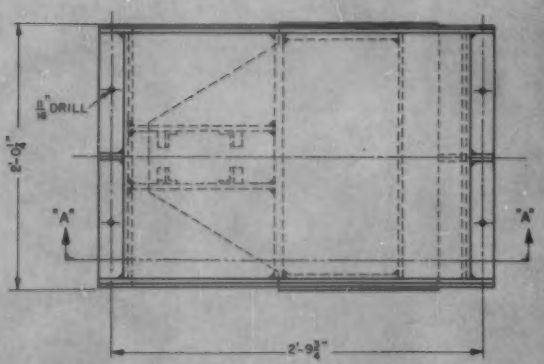
Builder of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

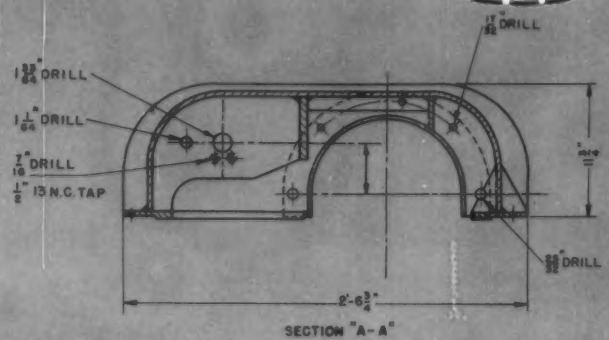
LITERATURE AVAILABLE: *For complete specifications on G&L 50 Series (floor-type) horizontal boring, drilling and milling machines, ask for Catalog No. 50-F.*

HOW IT'S DONE
with Giddings & Lewis

This Super Service Radial drills $1\frac{33}{64}$" hole in an all-steel hoist frame weldment for a 3-ton electric hoist, at 175 rpm, .025" feed per revolution. Other size holes drilled on side, top and inside of frame — in 3 setups — two $\frac{25}{32}$", three $\frac{17}{32}$", four $1\frac{1}{16}$", two $\frac{7}{16}$" and $\frac{1}{2}$" tap (13 N.C.) and one $1\frac{1}{64}$". At right—newly designed Davis special grooving tool cuts two different diameter grooves in gear case covers. This custom-engineered stub boring tool has adjustable cutter blocks with two sizes of tungsten carbide cutters.







SECTION "A-A"

Super Service Radial's complete pre-selection of 36 spindle speeds and 18 power feeds including 6 geared positive tap leads assures . . .

high-speed drilling, boring, reaming, spot-facing and grooving of cast-iron hoist gear cases at Harnischfeger Corp.

Constantly operating — almost 24 hours a day — this dependable Super Service Radial (5-ft. arm, 17" dia. column) with hydraulic pre-selector is extremely easy to operate. Just a turn of the dial makes possible instant and noiseless hydraulic change of all 36 speeds and 18 feeds. And all controls are conveniently grouped.

Installed in the Hoist Shop of Harnischfeger's Milwaukee plant, the Super Service Radial drills, taps and grooves large and small-diameter holes in cast iron gear cases for all sizes of electric hoists — 250-lbs. to 20-tons. The radial is also used for drilling large weldments and components for excavators and overhead electric traveling cranes.

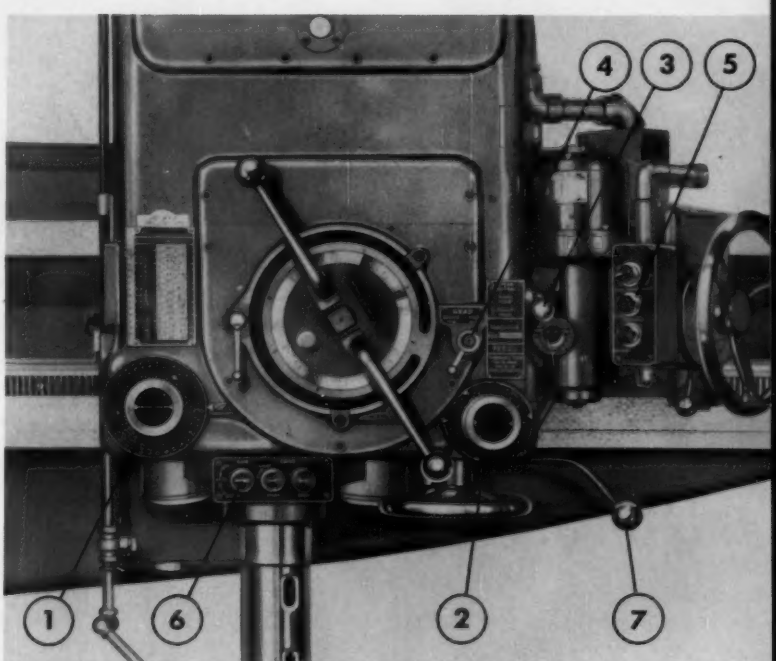
There are ten other shop-proven Cincinnati Bickford Radials serving at Harnischfeger's plants — 3, 5, 7 and 8-ft. arm. In fact a new track-type Super Service Radial with 8-ft. arm will be in operation early this year — while a G&L 7-ft. vertical boring mill is now on order.

For complete specifications on Super Service Radials upright drilling and tapping machines, see your nearest Cincinnati Bickford representative,or write for Bulletins R32 and R33.

Complete hydraulic pre-selection of 36 spindle speeds and 18 feeds

Only a turn of a dial is required to hydraulically pre-select all 36 spindle speeds and 18 feeds on the Cincinnati Bickford Super Service Radial. Speeds and feeds can be pre-selected while the spindle is running in either forward or reverse, or when stopped. After completion of first operation, machine hydraulically and automatically shifts to pre-selected settings, ready for operator to start next operation.

1. New speed dial for pre-selection of any one of 36 speeds for next operation while machine is completing first operation.
2. New feed dial for pre-selection of any one of 18 feeds for next operation while machine is completing first operation.
3. Neutral lever for hand feed operations.
4. Hydraulic head clamp selector button permits dual clamping of head and column simultaneously if desired.
5. Hydraulic column clamping—pushbutton controlled.
6. Power arm elevation and automatic hydraulic arm clamping is easy with convenient single, directional control switch.
7. Handy lever starts, stops, reverses spindle.

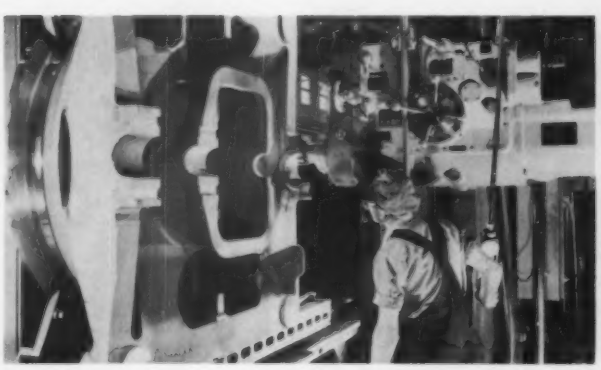


Super Service Radial with track type bases are available. Base is of unusually heavy construction. Hardened steel wheels travel on 80-lb. rails, 4' gauge. Available in smaller base 36" gauge using 40-lb. rails. Other standard models from 4-ft., 13" column dia., to 8-ft., 19" dia. offered with special bases and table mountings and full range of optional equipment.

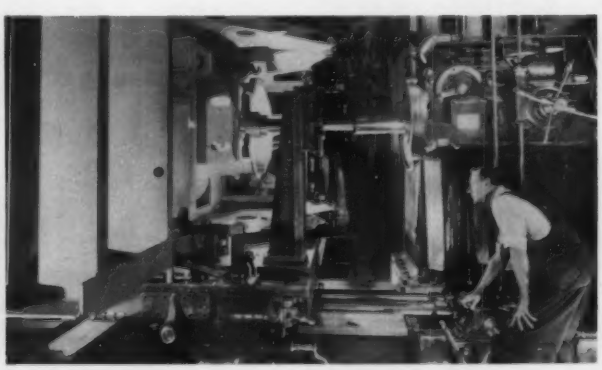
CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
OAKLEY, CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Layout Drilling Machines, Gang Drills and Precision-Drilling Machines designed for use with spacing table.

An 8-ton turntable for a 3-yard Koehring excavator on the Kaukauna horizontal in foreground undergoes a series of drilling and boring operations. For example, 11.251″ dia. bore (plus .002″ and minus .000″) for drum shaft, 6.001″ (plus .000″ and minus .002″) for hoist drum shaft, and 8.126″ (plus .002″ and minus .000″) for tract shaft. Approximately 20 holes from 15/16″ to 4″ are drilled, bored and reamed on one side of the huge turntable.



Three-ton steel plate carbody (6′x5½′x2½″) for Koehring excavator is rough and finish milled on this G&L Model 350-T horizontal. Spindle speed for rough milling is 20 rpm at 2.5 ipm and for finish milling 32 rpm at 3.1 ipm. Ten hours are required to rough and finish mill the corner pads, bosses, brackets; face-mill gear case, hub and bearings.



Operator performs finish boring with 18¼″ dia. Davis cutter . . . spindle speed of 7.6 rpm at .018-ipm feed. Sixteen rough, semi- and finish boring, facing, back-facing and counter-boring operations are performed on this 4-ton turntable — all in 18 hours. Finish machining operations are held to a tolerance of .002″.

HOW IT'S DONE
with **Giddings & Lewis**

...12 Giddings & Lewis machine tools help build heavy-duty construction equipment at Koehring Company

perform multiple precision boring operations simultaneously on two Kaukauna horizontals

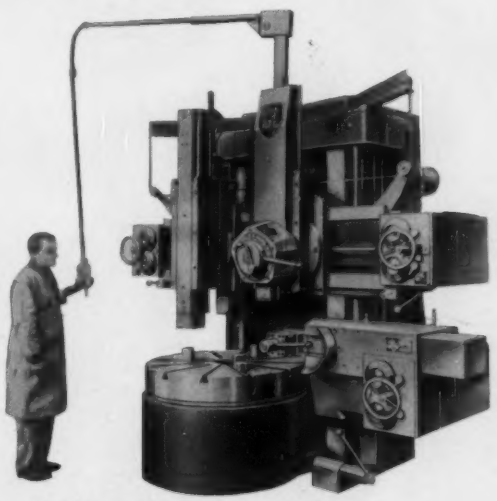
Standing on a common runway 36-ft. long, two Kaukauna Model 3045 horizontals each with 5″ dia. spindle (shown at left) perform double duty — boring, drilling and reaming — on large, all-steel weldments for excavators at Koehring Co., Milwaukee. Another Kaukauna horizontal is being added to present runway which is being extended.

The 6′ x 45′ stationary bed in front of the machine permits use of both horizontals for boring, drilling and reaming operations on the same workpiece, or each machine can be used independently on different workpieces.

A Giddings & Lewis 60″ x 96″ airlift rotary table is used on the stationary bed to rotate the workpiece and present different surfaces of the part to the machine eliminating crane handling operations. Centralized pushbutton controls, hydraulic spindle speed and feed selector dials plus high power and rigidity are combined to provide operator efficiency and high machine productivity.

In machining turntables for 2 and 3-yd. capacity excavators, each Kaukauna horizontal drills, bores, reams various size holes and faces as many as five surfaces simultaneously. Special fixtures with pilot bushings are used only to assist in directing the Davis boring bar with block-type cutters.

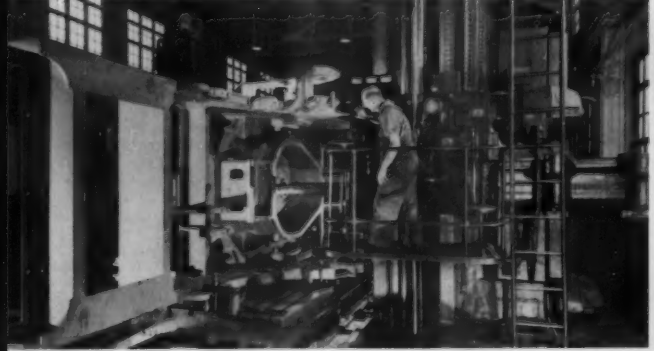
In addition to the Kaukauna machines, the Koehring plant has 10 other G&L machines. There are five other G&L horizontals, two Cincinnati Bickford Radials (6-ft. arm), two HYPRO Vertical boring mills (6-ft. and 10-ft.), and a Giddings & Lewis 42″ Vertical turret lathe.



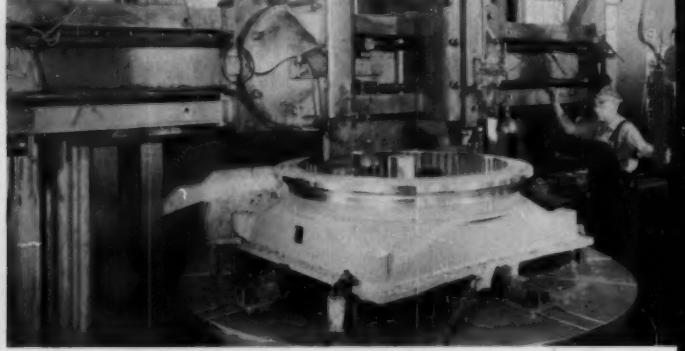
Giddings & Lewis 42″ Vertical Turret Lathe.

KAUKAUNA MACHINE & FOUNDRY DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
KAUKAUNA, WISCONSIN

Vertical Turret Lathes, Universal Radial Drilling Machines, Horizontal Drilling, Tapping and Boring Machines and Gray Iron Castings.

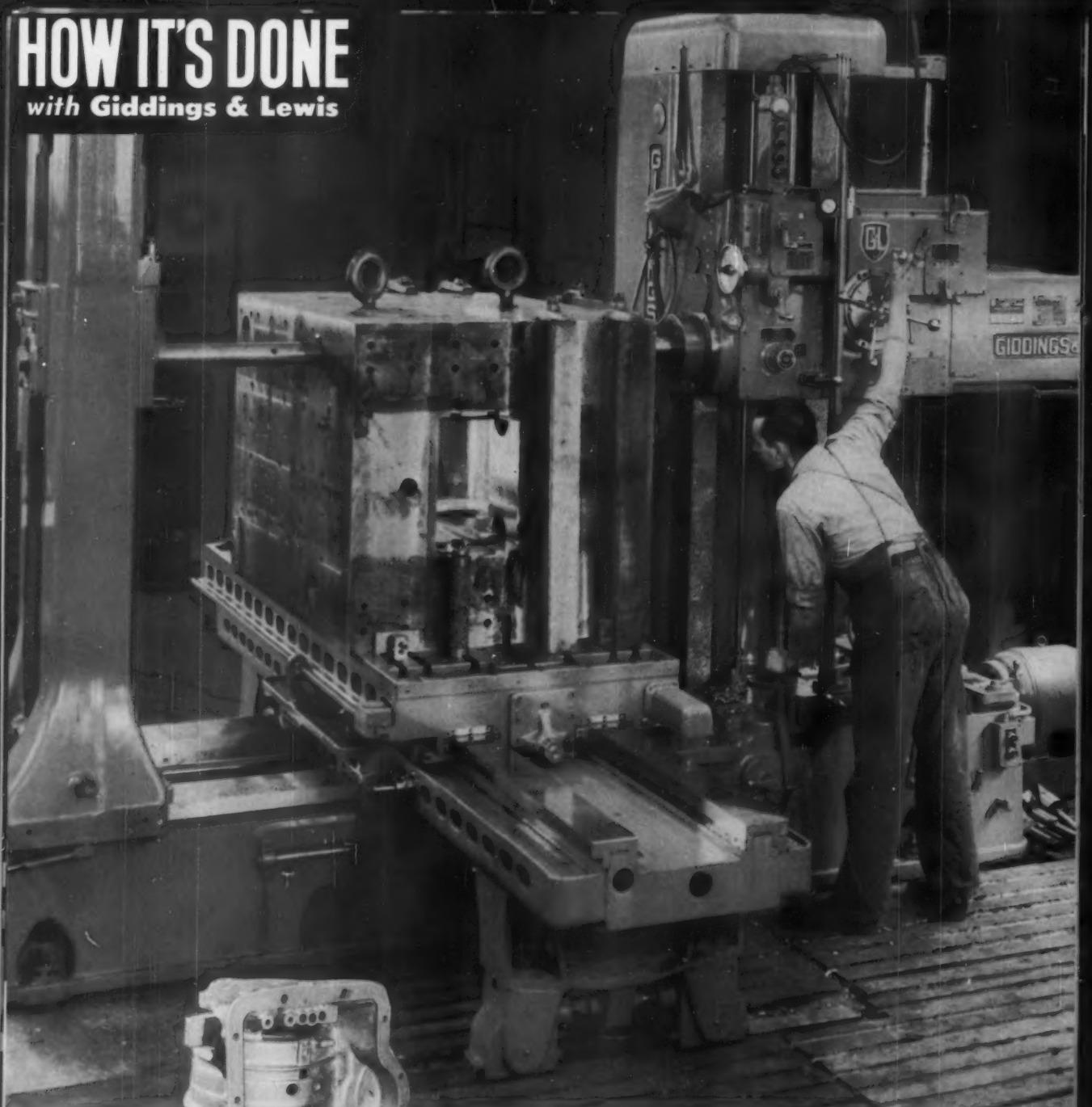


G&L's 560-T horizontal boring, drilling and milling machine with 6″ dia. spindle is the most versatile and busiest machine in the shop. Despite massive size of 8-ton turntable, various finish-boring, back-facing, back-and-counter boring operations are held to tolerances of .001″ and .002″.

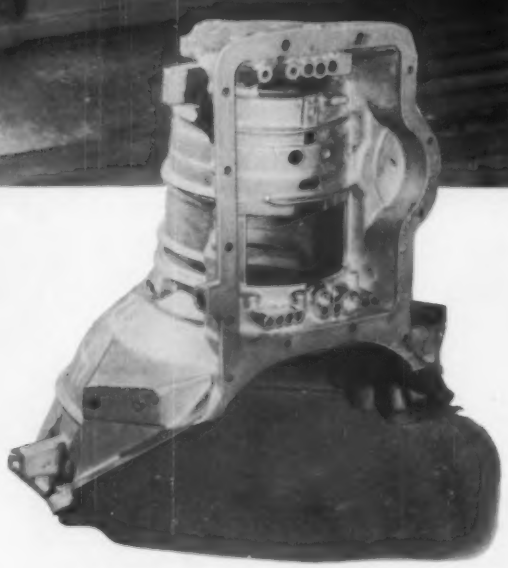


Giddings & Lewis Vertical boring and turning mill, one of two at Koehring, is used for precision machining of large carbodies for excavators. The vertical mill turns control hub, bevels face of ring gear, turns two outer diameters as well as inner diameter on the gear teeth of carbody frame.

HOW IT'S DONE
with Giddings & Lewis



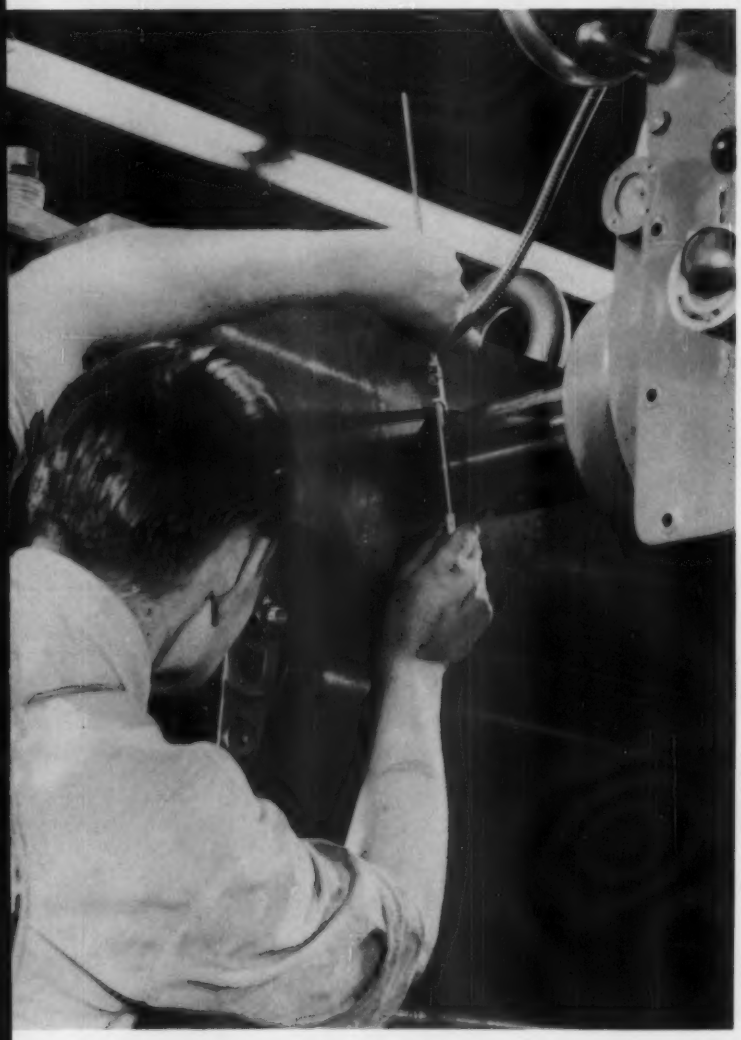
Picture shows G&L's Model 340-T finish boring 3½" dia. hole to a tolerance of plus or minus .001". The machine spindle, with Davis 8' bar, mounting a 3½" dia. cutter block, is used for finish boring. When completely drilled, bored and milled, approximately 4 tons of chips are cut off of huge die blocks.



An aluminum die-cast housing for a popular 1957 automobile automatic transmission is shown. Approximately 20-pound shot of metal is required for each housing. The die mold for precision die casting is one of many types of dies machined on the Model 340-T at Atols Tool & Mold Corp.

Cut 4 tons of tool steel from 14½-ton automotive transmission die blocks

with Giddings & Lewis Model 340-T (table-type) horizontal at Atols Tool & Mold Corporation



View of machinist checking inside finish bore diameter (plus or minus .001"), with vernier caliper.

According to Atols' shop superintendent, G&L's Model 340-T horizontal (table-type) has drastically cut production time on boring, drilling and milling of 28,800-lb. die blocks to be used for production of die cast aluminum transmission housings for one of the nation's leading automotive manufacturers. G&L horizontal's remarkable performance is due to its versatility, ease of operation and productivity.

For example, three 2½" dia. angle holes inside the die cavity, 5" dia. bores and 7° tapered holes for core lock pins are drilled and finish-bored to tolerance of plus or minus .001". Counter-bore on the outside surface of the die blocks are machined in the same setup.

After the die blocks are rough-machined, they are heat-treated in Detroit because of their size, and finish-machined at Atols Tool & Mold. Out of total machining time of 2,000 hours, about 400 hours are spent on the G&L machine. Approximately 4 tons of steel are removed.

The Model 340-T with 4" dia. spindle . . . 45 speeds ranging from 10 to 1300 rpm and 18 feeds from .005 to .250 ipm . . . is equipped with extended saddle and saddle support, and in-the-floor auxiliary runways and standard scales and vernier for accurate setting of the headstock and table to .001".

30 Series horizontals are built 4" dia. spindle (20 hp) and 5" dia. spindle (25 hp). They can be furnished with capacity-boosting optional accessories such as angular milling attachments, continuous-feed facing and boring head, automatic electric-operating positioning device, *Dupli-Tracer* (2 or 3 dimensional contour tracing and 360° profiling), plus other time-saving and profit-making accessories.

LITERATURE AVAILABLE: *For complete specifications on G&L 30 Series (table-type) horizontal boring, drilling and milling machines, ask for Bulletin No. 30-T.*

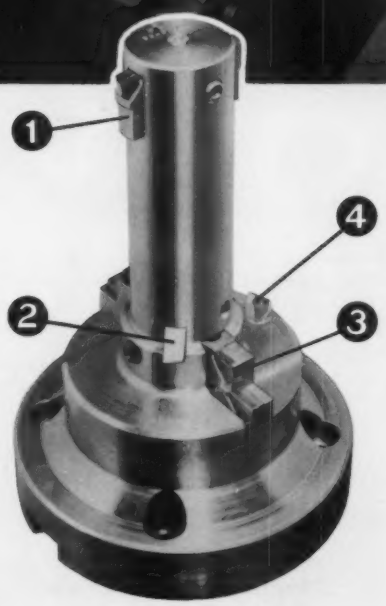
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

HOW IT'S DONE
with **Giddings & Lewis**

Left way-type boring head with Davis flange-type stub boring bar rough-bores, finish-counterbores, finish-faces and chamfers one end of workpiece, then retracts to original station.

Right way-type boring head with Davis flange-type stub boring bar finish-bores, finish-counterbores, finish-faces and chamfers workpiece from other end. Head then retracts to original station—and machine is ready to receive second workpiece.



Davis special block and flycutter type boring tools perform multiple cutting operations

1. Expandable cutter block with tungsten-carbide cutters to rough and finish-bore three different size bores.
2. ½" square tungsten-carbide flycutter to chamfer (45°) six diameters.
3. Multi-cutter block with 4 tungsten-carbide cutters, 2 tungsten-carbide cutters to counterbore five diameters. 2 tungsten-carbide cutters to face five diameters.
4. ½" square tungsten-carbide cutter to chamfer (45°) seven different diameters.

Creative tooling pays off at Baldwin-Lima-Hamilton

Two spindle horizontal performs multiple machining in a single pass — thanks to custom-built Davis stub boring tools

This specially built Kearney & Trecker two-spindle boring machine is equipped with two sets of Davis-designed and engineered flange-type stub boring bars that really pay off in production! These high-efficiency Davis tools bore, counter-bore, face and chamfer—in a single pass—various sizes of tread rollers for crawler-type construction machinery at Baldwin-Lima-Hamilton Corp., Lima, Ohio.

Here's how Davis does it! Each standard way-type boring unit, located on opposite ends of the machine, is equipped with a Davis flange-type block and flycutter-type boring tool. The left boring head machines one side of the workpiece, retracts — and the right head machines its side of the tread roller.

Each Davis-designed stub tool has an expandable two-cutter block, a multi-cutter block with four cutters and two angular fly cutters—all with tungsten-carbide cutter tips.

The cutters — located at different distances and positions on the stub boring bar — perform a remarkable sequence of machining operations as the spindle feeds into the workpiece.

Davis offers a complete line of standard blocks, boring heads, bars and tool sets, and custom tooling service to solve any routine or special boring problems. See your local Davis field engineer. Write for Catalog No. 304.

DAVIS BORING TOOL DIVISION

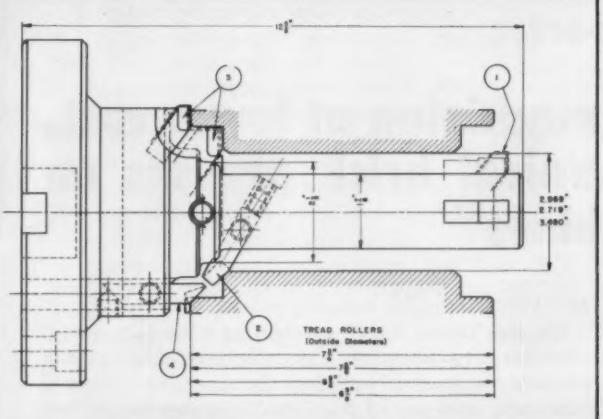
GIDDINGS & LEWIS MACHINE TOOL CO.

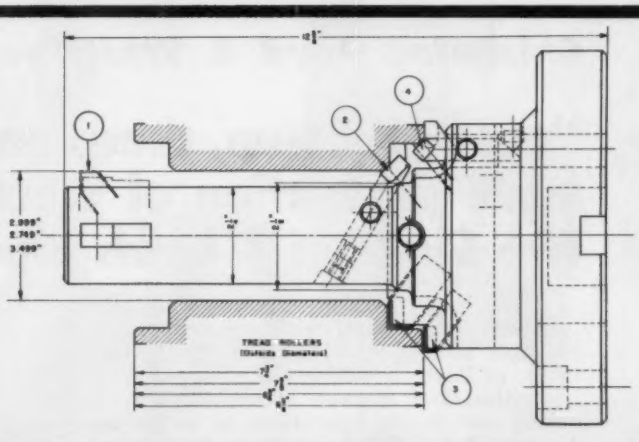
FOND DU LAC, WISCONSIN

Line and Stub Boring Bars, Boring Heads, Block-Type Cutters, Planing and Turning Tools, and Special Production-Engineered Job Tooling.

Special block and flycutter type boring tools . . . . . .

(Left hand cutters) **(Right hand cutters)**

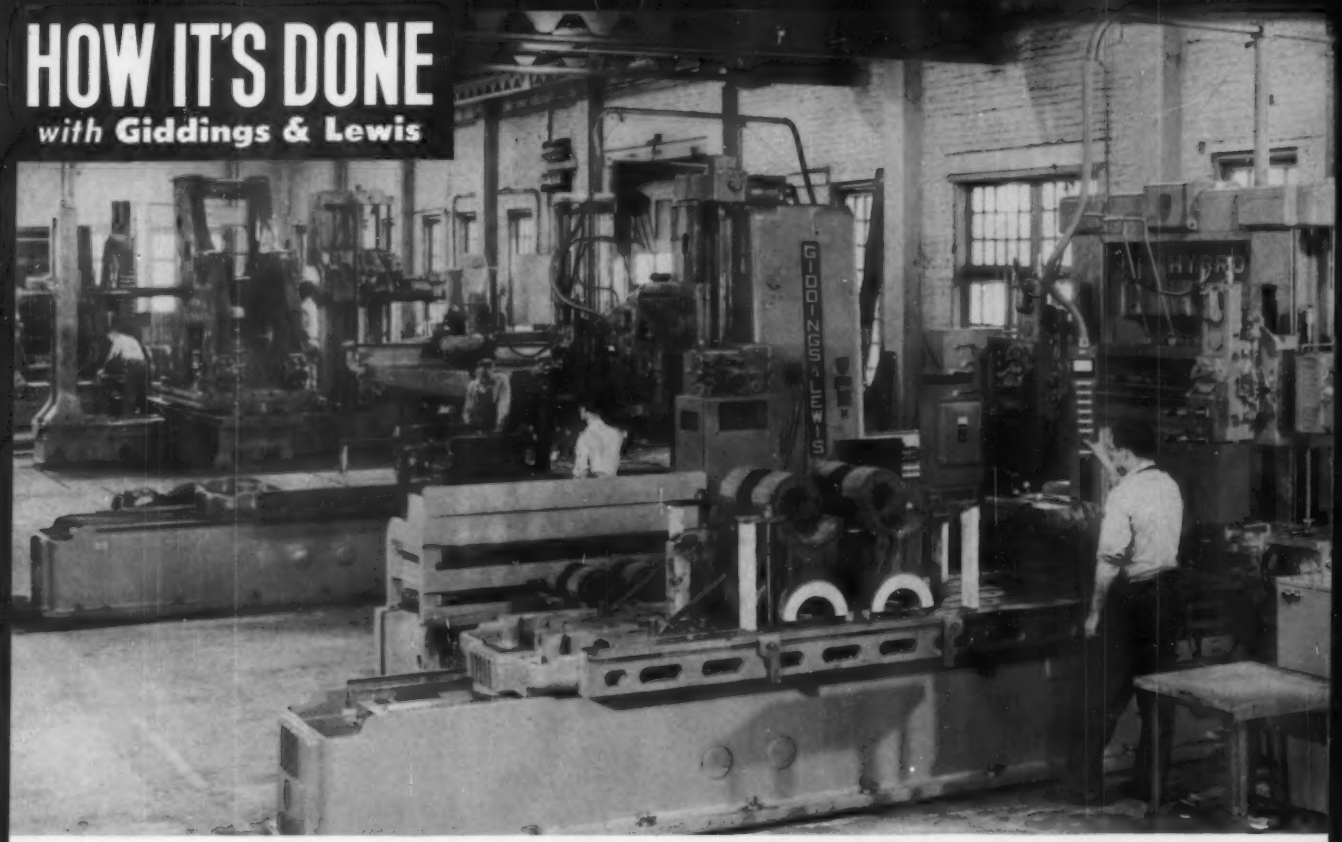




Davis offers a complete line of standard boring, turning and planing tools

Extension Boring Head
Stub Boring Tools with Unfinished Shanks
8-Position Tool Holders
3 and 1 Boring Head
Line Boring Bar with 3 and 1 Boring Head
L-Type Boring Tools
Carbide Tip Planer Tools
Quick Change Arbor and Sleeves
Interchangeable Block Type Tooling
Micrometer Adjustable Stub Boring Tool Set

HOW IT'S DONE
with **Giddings & Lewis**



Four of five G&L machines used for various machining operations on Boyd mechanical brick presses are HYPRO double housing planer and openside planer, Super-Service Radials (6-ft. and 4-ft. arm) and Model 350-T horizontal. Another Model 350-T horizontal boring, drilling and milling machine will be installed in 1957.

Chisholm, Boyd & White reports:

"ease of set-up, precision machining at lower cost, more production of mechanical brick presses on five Giddings & Lewis machines"

. . . these are the words of Frank Hevrdejs, works manager of Chisholm, Boyd & White, manufacturers of Boyd Brick Presses, Chicago, Illinois.

As illustrated in photo above, rough and finish-boring and facing operations of large holes on 8½-ton Model "Y" brick press frames are performed on G&L's horizontal.

The versatile Model 350-T, with 5″ dia. spindle, is equipped with extended saddle, saddle supports, and auxiliary in-the-floor type runways which easily handle a casting — 108″ by 110″ by approximately 10″ thick — weighing 4½ tons.

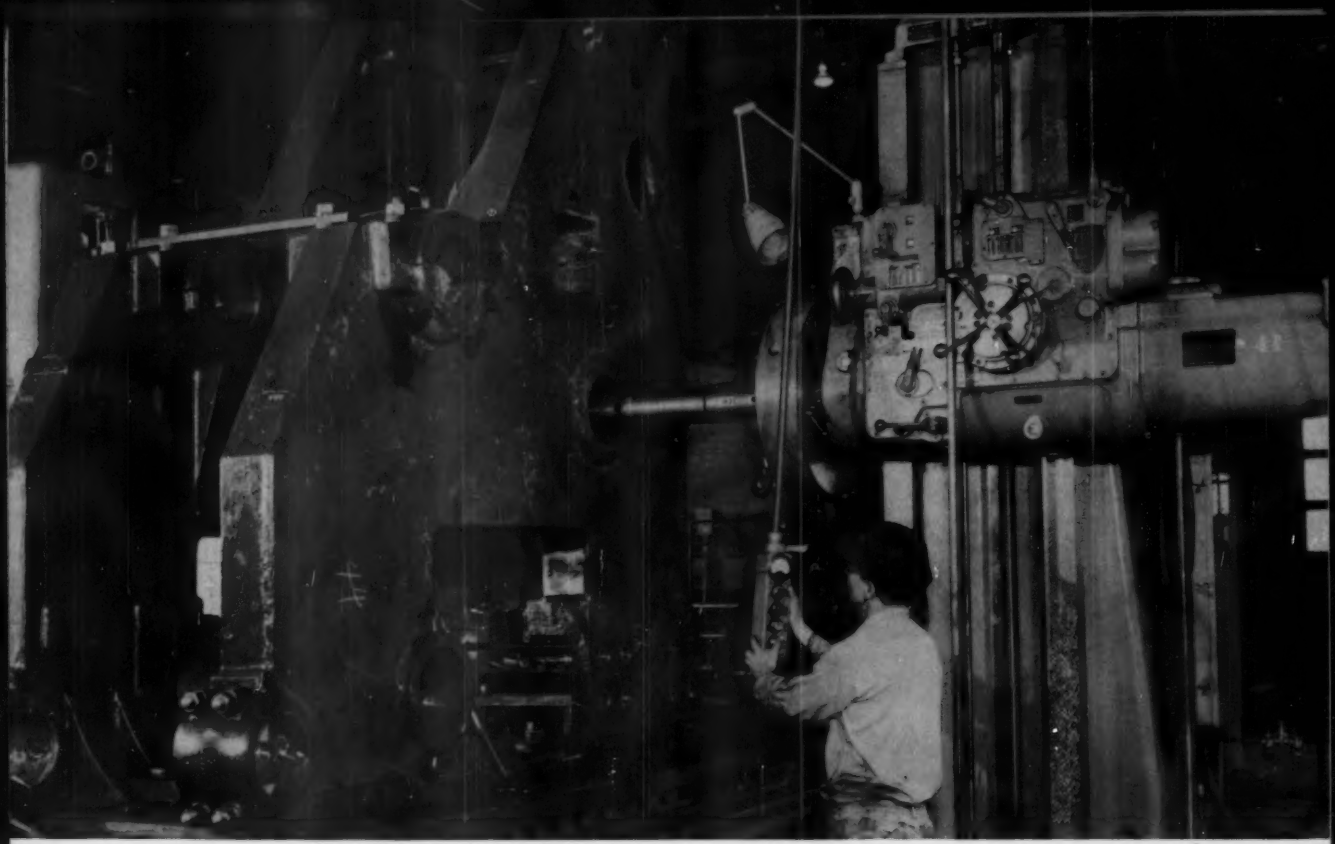
Prior to boring, the bases and vertical surfaces on the frame are planed on a Giddings & Lewis 48″ HYPRO double housing planer.

On the Model 350-T machining time is reduced considerably because the operator can quickly position table and headstock for bores at different locations, and use of machine's vernier scales has resulted in 2½-hour reduction in floor-to-floor time . . . a real time savings.

Davis 5″ dia. line-boring bar with block-type carbide-tipped cutters is used for precision boring. Accuracy required: plus or minus .001″.

Bearing surfaces are faced with G&L's continuous-feed facing head to close tolerances.

For complete specifications on G&L 30 Series (table-type) horizontal boring, drilling and milling machines, contact your nearest G&L representative, or write for Bulletin No. 30-T.



Model 350-T (table-type) horizontal rough and finish bores four 5" dia. holes to plus or minus .001" tolerance in both right and left frames of Boyd Brick Press using Davis boring bars and block-type cutters.

Optional arrangements and equipment include:

1. Built-in rotary table with power drive eliminates numerous work set-ups.

2. Automatic electric positioning device for both headstock and table travel assures accurate machine setup, repetitive to .0002".

3. Improved measuring device with dial indicators and precision end measures . . . readings to .0001".

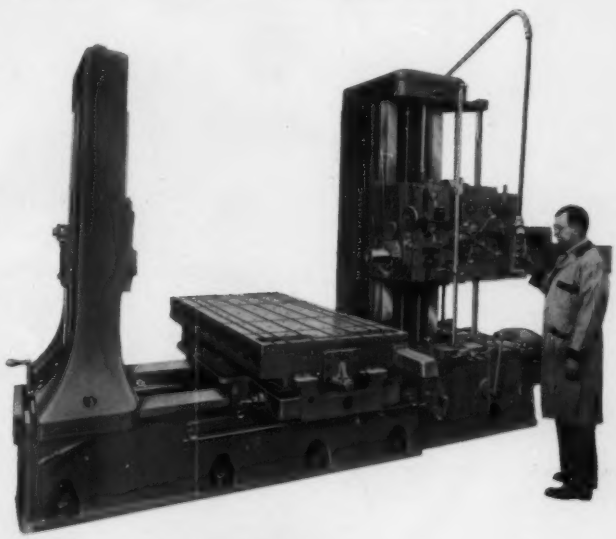
4. Built-in precision thread lead device for cutting of precision threads to any standard prescribed form, pitch and depth.

5. Super-sensitive *Dupli-Tracer* for 2 or 3 dimensional stepless contour tracing and 360° profiling.

6. Exclusive G&L "Lubri-Cool" system connected to headstock and milling feed for machining accuracy under heavy loads and high ambient temperatures.

7. Continuous feed facing head, mounted to the spindle sleeve or one line boring bar, for machining external or internal surfaces beyond the range of the machine spindle.

8. Various angular milling attachments for milling angles and hard-to-reach surfaces.



30 SERIES HORIZONTALS

Two popular horizontals in the 30 Series line are the Model 350-T with 5" dia. spindle (25 hp) and Model 340-T with 4" dia. spindle (20 hp). Other G&L horizontals with spindle diameters ranging from 3" to 14", main motor drives 10-150 hp, are available.

G & L *and* HYPRO DIVISION

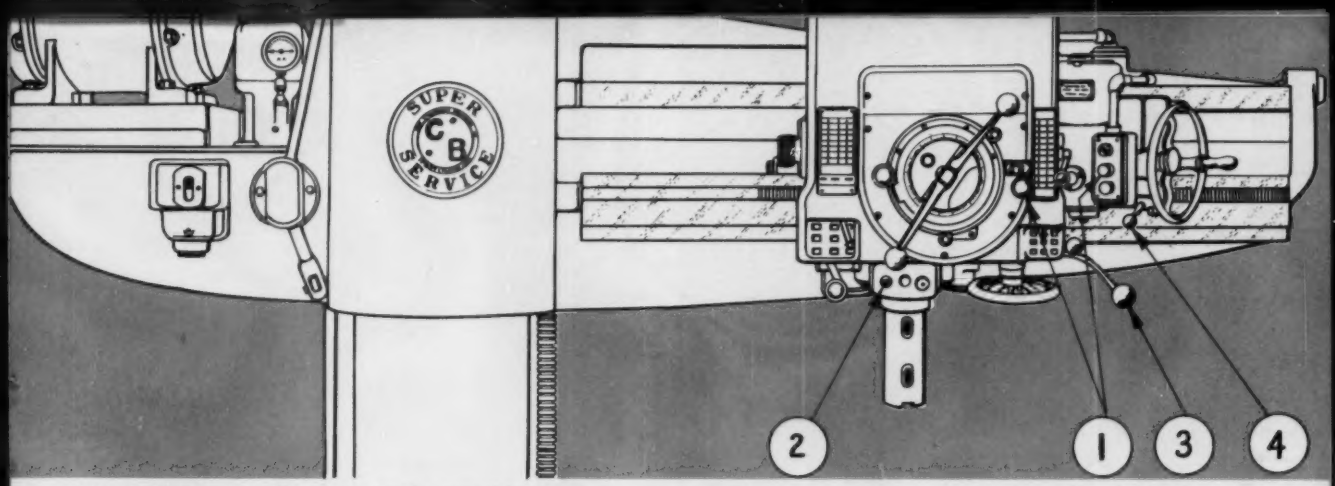
GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers, Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

HOW IT'S DONE
with **Giddings & Lewis**

Production drilling of a standard die shoe, 20″ x 26″ x 2″, for an all-steel die set is done on a Cincinnati Bickford Super Service Radial. A total of 12 holes is drilled: four 1¾″ dia. at 145 rpm, .020″ feed per revolution, and eight $^{27}/_{64}$″ dia. holes, and ½″ — 13 thread tap. After dies are drilled and tapped, they are placed on a roller conveyor which moves the piece to a precision boring machine.



Simplified, centralized controls provide —

1. Finger-tip operation of powerful hydraulic head and column clamp.
2. Fast power-arm elevation with automatic clamping.
3. Easy-to-reach spindle control for start, stop and reverse.
4. Rapid head movement with power traverse.
5. Automatic pressure lubrication to arm barrel and elevating nut.

Die-set drilling production increased 25 to 30%!

They're doing it at Superior Steel Products with a Cincinnati Bickford Super Service Radial

An increase of 25-30% in the production drilling and tapping of all-steel (SAE-1018) precision die sets of various sizes on a Cincinnati Bickford Super Service Radial with 5-ft. arm, 17-in. dia. column is enjoyed by Superior Steel Products Corporation, Milwaukee, Wis.

Principal reasons for this outstanding production, according to Edward Mezydlo, plant superintendent, are: Radial's simplicity enables operator to quickly change from one speed to another permitting instant selection of all 36 spindle speeds, 12 to 1500 rpm. There are 18 feeds ranging from .004″ to .125″ per revolution. These include six tap leads, 8 to 27 threads per inch.

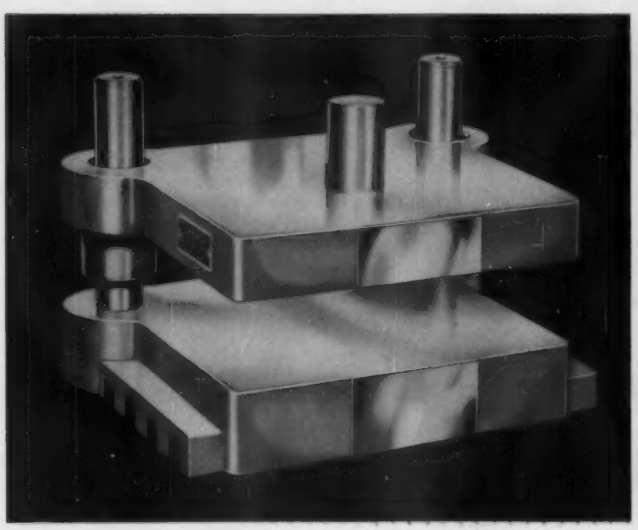
The hydraulic clamping of column and head is simple, easy and quick. It permits drilling a variety of holes to a greater degree of accuracy.

Superior all-steel die sets range in size from 3″ x 3″ to 40″ x 120″ . . . thickness varies from 1¼″ to 5″. Superior also produces precision guide pins, bushings and bolster plates.

Because of the Super Service Radial's performance, a new 6-ft. C.B. Radial with 19″ dia. column has recently been installed at Superior. It replaces a competitive heavy-duty radial.

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
OAKLEY, CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Layout Drilling Machines, Gang Drills and Precision-Drilling Machines designed for use with spacing table.



Superior precision all-steel die set with safety flanges drilled on Super Service Radial.

Precision checking of accurately drilled and bored die set which meets rigid quality standards.

G&L and HYPRO Division — operates one of the finest machine tool plants in the world devoted to the design and manufacturing of heavy-duty precision machine tools.

Cincinnati Bickford Division has a reputation as a leader with their line of Super Service Radial drilling machines. This division was acquired by G&L in 1955.

Serving the metalworking industry throughout the world for more than 96 years . . .

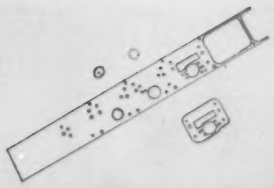
Giddings & Lewis has been in continuous operation since 1859 and is the foremost designer and manufacturer of an extensive range of precision heavy-duty machine tools, accessories, attachments and cutting tools. The growth of G&L to a point where it comprises four individual operating divisions with a combined manufacturing space totaling over 750,000 square feet serves to illustrate the importance of vision and alert engineering — plus capacity to produce. The developing of ideas . . . their proper evaluation . . . and the constant striving to build products that are the best in their class — all have combined to make Giddings & Lewis a major force in metal-working programs of American industrial life.

Davis Boring Tool Division manufactures a complete line of boring, planing and turning tools for performing virtually any machining operation. G&L acquired this division in 1945.

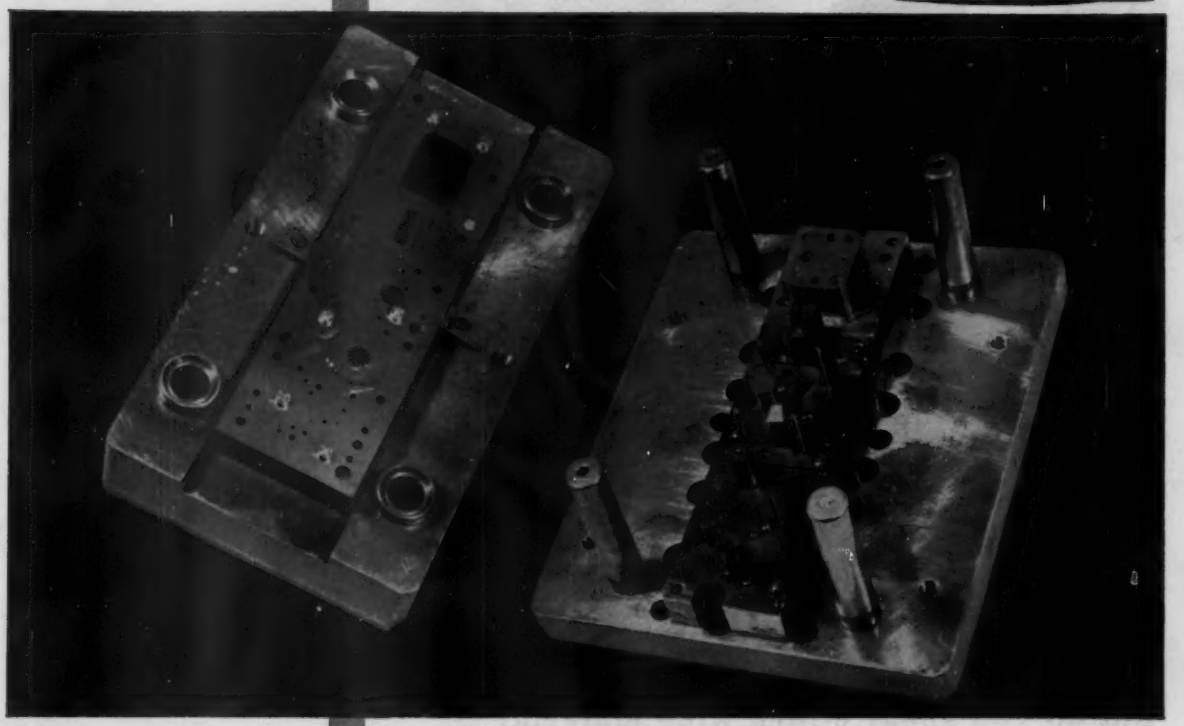
Kaukauna Machine & Foundry Division designs and manufactures Vertical Turret Lathes, Universal and Horizontal drilling and boring machines. This division was acquired by Giddings & Lewis in 1955.

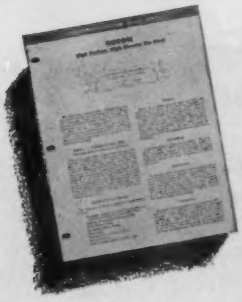
GIDDINGS & LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN



This HURON Lamination Die Gave Initial Run of 426,000!





Write for BLUE SHEET on HURON

This concise four-page folder gives all needed handling and shop treatment details on Huron. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. AM-86

A-L HURON high-carbon, high-chrome die steel was the material used in this motor lamination die. Here was the result when the die was run on a 45-ton Bliss press at 210 strokes a minute:

1. Initial run was 426,000 pieces
2. Average run since has been 250,000 pieces
3. Although burr tolerance is .003″, grinding of punch and die between runs has not exceeded .008″.

HURON WAS SELECTED because of its known high resistance to wear, especially under heavy pressures, and its excellent non-deforming qualities. Because Huron is an oil-hardening steel and hardens uniformly to a great depth, a consistent production rate after each grind was assured.

There's an A-L Tool Steel that will help solve your cutting, forming or blanking problem. Call our nearest office or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854

You wouldn't cut out paper dolls with a hedge clipper!!

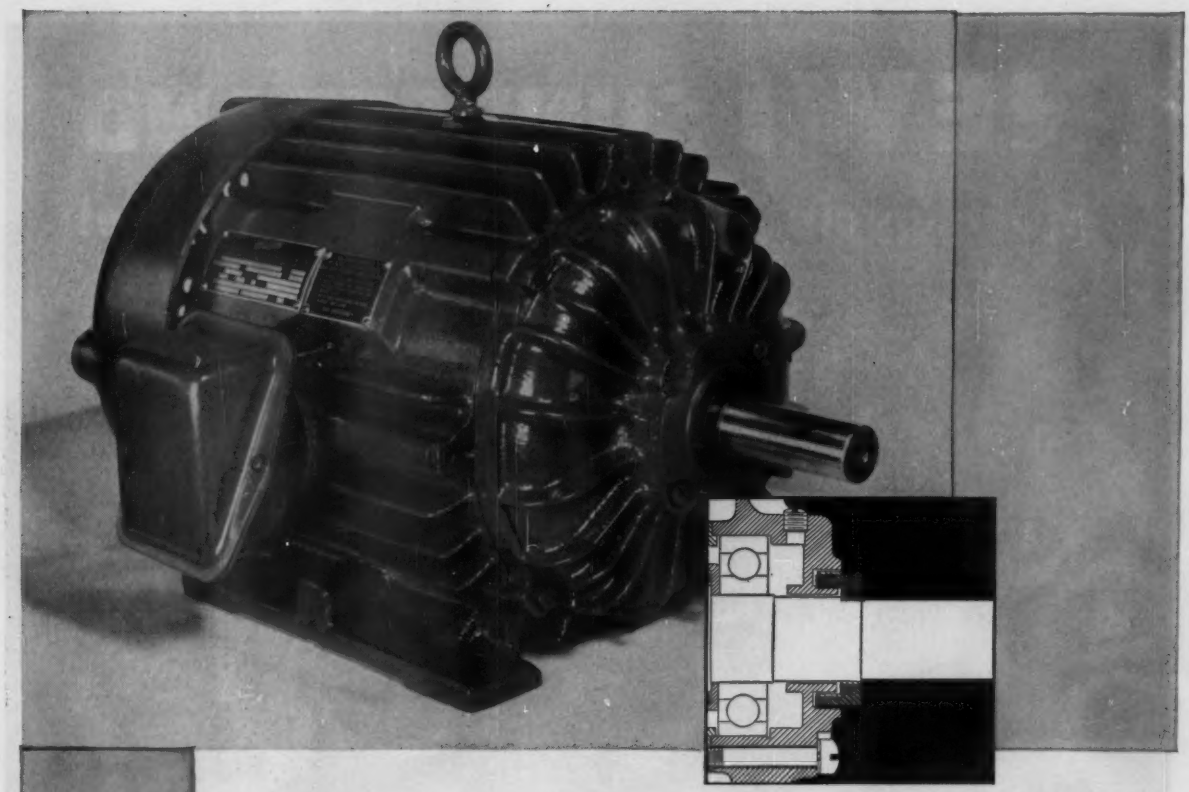
But do you shear 6-inch wide material with a 10-foot shear?

Cutting a small piece of light metal, plastic or rubber on a big shear is even more expensive than it is exasperating. Yet many shops, out of necessity, tie up big shears with small work.

That problem is solved by the New Lodge & Shipley 24" Speed Shear. Specially designed for fast cutting of small pieces, it has a capacity of 1/8" x 24" mild steel. Its unique work table is provided with holes which allow fast set-up of guides, templates and protractors for production of straight-side blanks at speeds up to 120 strokes per minute.

A 24" Speed Shear may easily pay for itself merely in freeing a big shear from wasteful small jobs. Investigate its possibilities in your plant. For detailed Bulletin No. PS-12, write: **The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio**

Lodge & Shipley



Securely sealed for low maintenance —

TOTALLY ENCLOSED FAN COOLED MOTORS

Century

When motor maintenance goes down, production goes up. Century TEFC Motor *protects itself* from dust, grit, chemical fumes, moisture. Shaft openings at each end are labyrinth-sealed, and there is a precision clearance between metal seal and bearing bracket.

Outside, a hose or whisk broom quickly cleans it. External fan forces jets of cooling air across the frame. Inside, vital motor parts are completely sealed off from injurious atmosphere. Factory lubrication of bearings is adequate for several years' service under normal conditions; however, whenever required bearings may be relubricated through grease plugs.

For full facts on your specific application, call the Century District Office or Authorized Distributor nearest you.

CENTURY . . . building TEFC Motors for 25 years

CE-66R

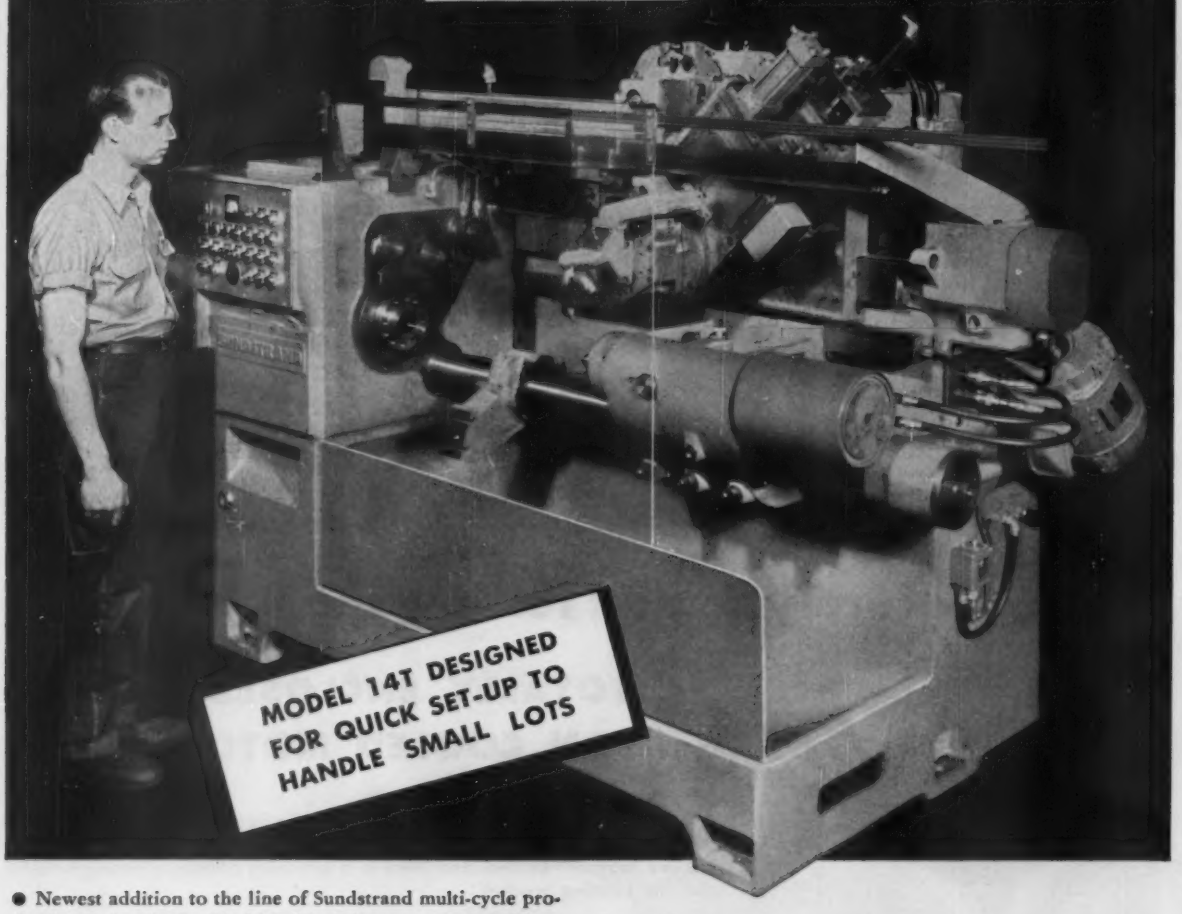
Performance-Rated®
MOTORS
1/20 to 400 H.P.

CENTURY ELECTRIC COMPANY

1806 Pine Street • St. Louis 3, Missouri • Offices and Stock Points in Principal Cities

NEW! SUNDSTRAND

Multi-cycle *Hydraulic* Tracer Lathe!



● Newest addition to the line of Sundstrand multi-cycle production lathes is the Model 14T with tracer control. Now, these 40-horsepower production lathes are available with three types of controls: hydraulic tracer, mechanical, and punch card — giving you the one best machine for your turning jobs. Hydraulic tracer control on the Model 14T makes machining of irregular shapes both fast and profitable. Only one template, readily accessible on the front of the machine, is required for multi-cycle cuts. For example, ruffing, semi-finish, and finish cuts all may be part of one automatic cycle. Shoulder facing tools can be provided where required, for squaring and similar operations.

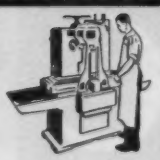
AVAILABLE WITH 2, 4, OR 8-SPEED HEADS

Maintaining correct speeds and maximum horsepower on the Sundstrand multi-cycle lathes is assured by transmission-type heads that provide automatic speed changes. These heads are available in 2-speed, 4-speed, or 8-speed types, enabling a machine to be selected with spindle speeds ranging from 245 to 3025 rpm as best suited to production requirements of your plant.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND

*"Engineered Production" Service**

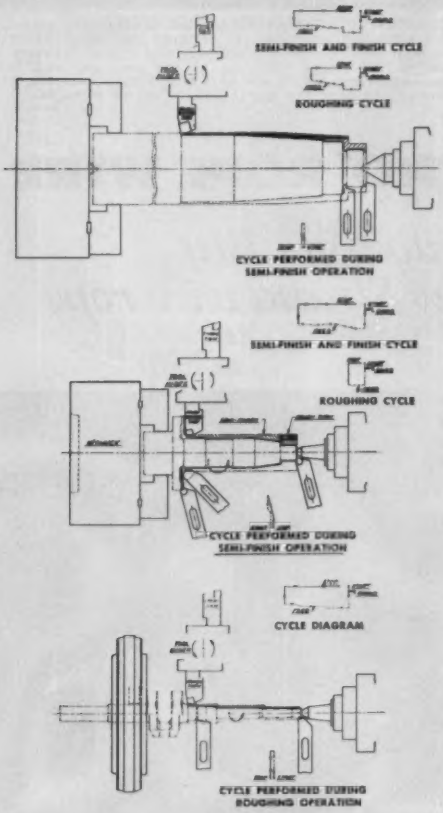


TURRET FOR RUFF AND FINISH TOOLS

Indexing turret for turning tools provides ruff and semi-finish cuts with a ruffing tool and a finish cut with a finishing tool all in one automatic cycle.

TYPICAL TOOLING SETUPS

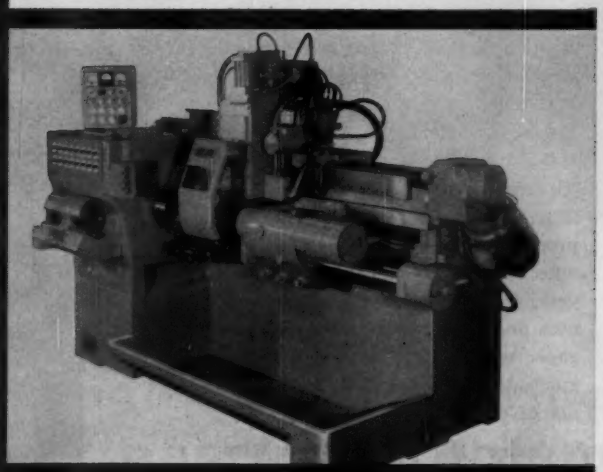
Jobs shown here are typical of those handled on Sundstrand Model 14 multi-cycle lathes.



OTHER AVAILABLE TYPES

PUNCH CARD CONTROL . . .

With this system, decimal dimensions on engineering drawings are punched in standard business machine cards with a standard key punch. The cards are then fed into a reader, as shown above, which feeds the electrical signals into a machine control unit. This unit then controls all functions of the machine.



ADDITIONAL FEATURES

Here are a few additional features of Sundstrand multi-cycle lathes:

INFINITELY VARIABLE FEEDS from 7½ to 29½ inches per minute.

LARGE CHIP CAPACITY in large open cavity below facing tool carrier. Vertical ways are free from falling chips.

EASY FRONT LOADING with center line of spindle only 9 inches from front of machine.

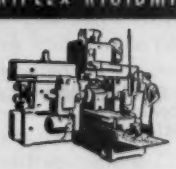
LENGTH BETWEEN CENTERS of 30, 40, 50 or 60 inches.

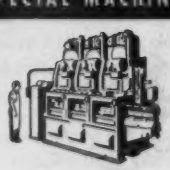
More information about Sundstrand multi-cycle lathes is available in Bulletin 176. Write for it today.

MECHANICAL CONTROL . . .

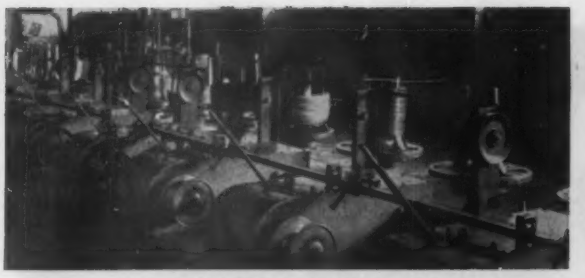
On the Model 14 mechanically operated machine the turning slide and shoulder facing tools are actuated independently. No template is required for step turning, and micrometer adjustment for steps is easy to set for size corrections due to material changes, etc. There is no lost motion for re-set because index takes place during cut.

TRIPLEX RIGIDMIL® | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.



SPOOLING OPERATION—Coils of Youngstown Wire are placed on winches from which the wire passes over a sheave and guide onto the bobbin in the foreground.

STRANDING OPERATION—Filled bobbins are placed in the stranding machines for forming the individual wires into strands. In these machines from 7 to 41 bobbins are placed, all wires emerging at the forward end being formed into a single strand which passes over the draw works and onto the larger bobbin shown at right.

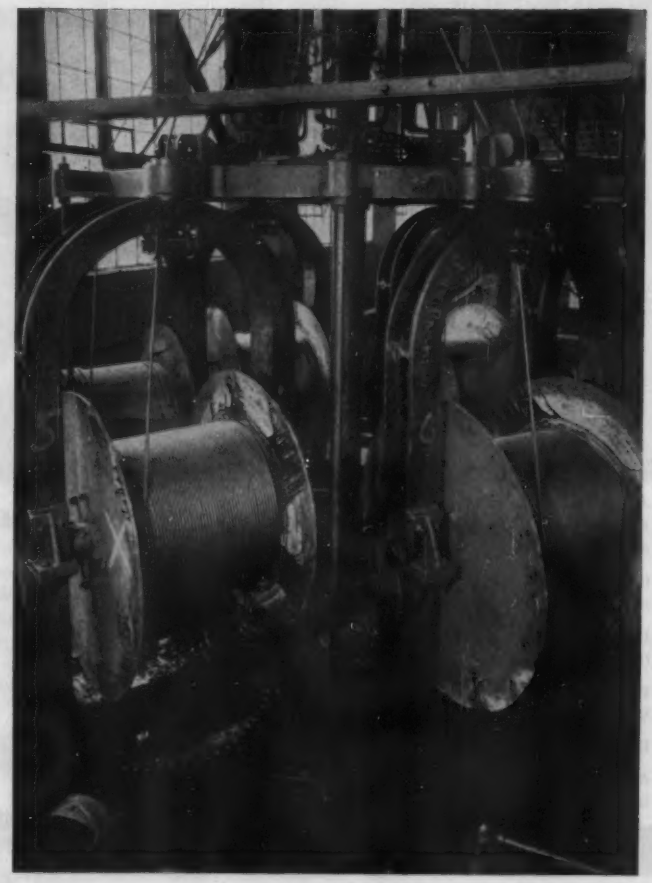
YOUNGSTOWN "YOLECTRO" ROPE WIRE

... helps maintain high quality of Broderick Bascom Yellow Strand wire rope

For over half-a-century Broderick & Bascom Yellow Strand wire rope has enjoyed a world-wide reputation for excellence of both workmanship and finished product. To maintain their high quality standards, they use Youngstown "Yolectro" High Carbon Rope Wire as the basic material in the production of their various brands of wire rope. They have found over the years that it offers the required toughness and strength, abrasion resistance, gage uniformity, and flexibility to guarantee a Broderick & Bascom product of consistent quality.

"Yolectro" High Carbon Rope Wire is quality-controlled to provide the correct balance of properties to meet your most critical requirements. Why not make it your specification for quality production? It's available in both Bright and Galvanized finishes in all high carbon grades.

Metallurgical assistance or additional information may be received from your nearest Youngstown District Sales Office. Why not write or phone today?



CLOSING OPERATION—In this machine, six finished strands are formed around a center core of either fiber or independent wire rope.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
General Offices - Youngstown 1, Ohio
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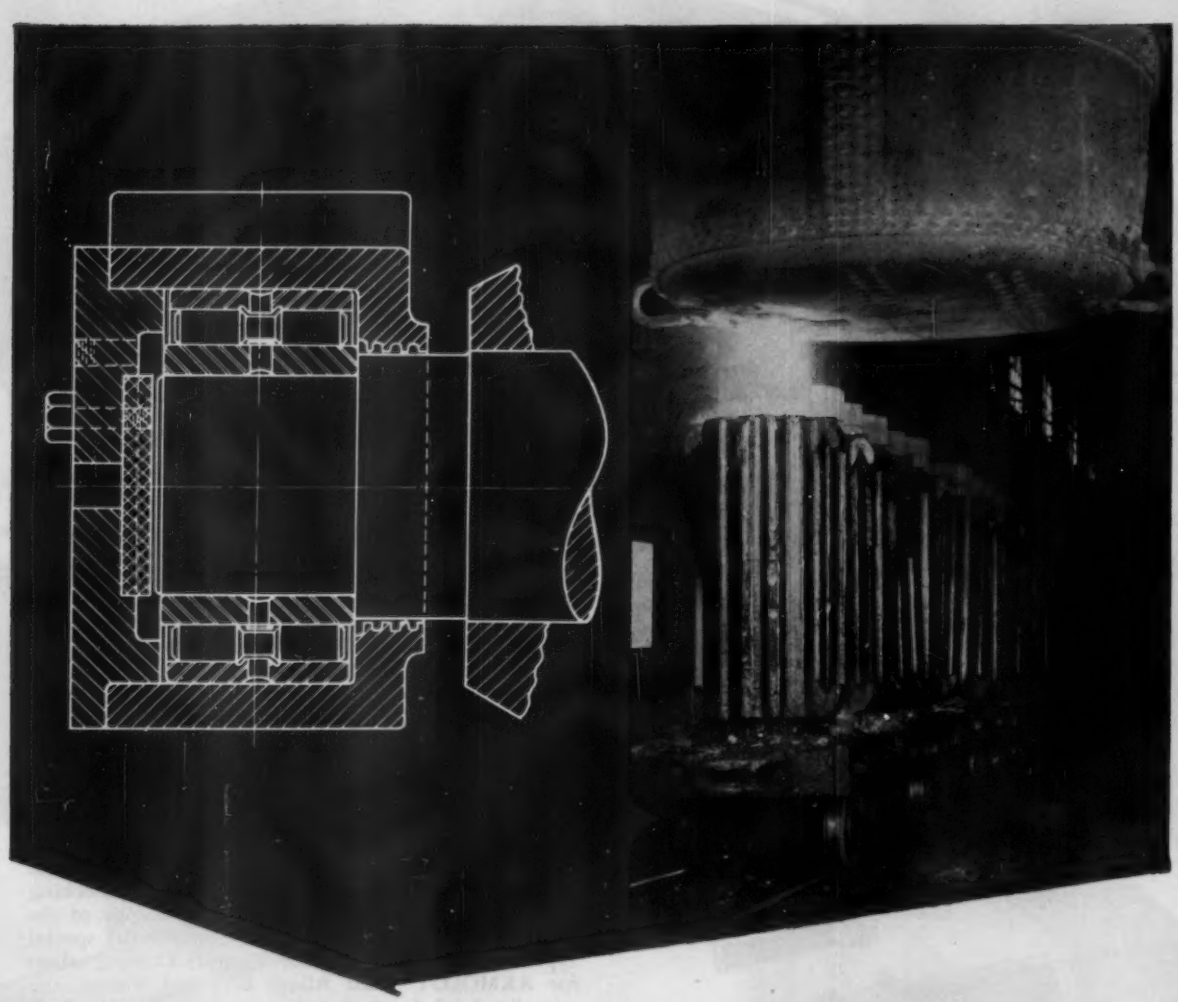
QUALITY YOUNGSTOWN SERVICE

Producers of Quality Carbon and Alloy Steels for Over Half-a-Century



Bearings, Inc. engineering service . . . solves another bearing problem

Ingot mold cars for a large tube mill were continually out of service due to the short life of babbitt, bronze or other bearings originally supplied in the cars.

The Trouble? Bearings, Inc. engineers found shock loads far beyond the capacities of the original bearings. Extreme wear on bearings due to excessive skewing, bent axles and uneven track.

The Answer. Shown above is the Bearings, Inc. drawing of the installation that replaced the original bearings. It has greatly increased load capacity and no dimensional change is required in the shaft or bearing housing.

The Result. The new bearing is designed on a new principle that keeps rollers in line and eliminates skewing. Shock loads due to uneven tracks have little effect on our installation for its construction makes possible a greater number of rollers available to support the load at all times.

This is just one of the many such problems we have solved for our customers. In all cases we supply only bearings we are authorized to distribute. They are new and come to you fresh in the manufacturers' boxes.

If you have a bearing problem or need replacement bearings in a hurry — call or write our branch nearest you, they're ready to give fast service.

Rendering bearing service in the territories adjacent to our branches, listed below.

BEARINGS, INC.

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute
PENNSYLVANIA: Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Wheeling
NEW JERSEY: Camden • **MARYLAND:** Baltimore
DELAWARE: Wilmington •
Subsidiaries: Balanrol Corp. • Buffalo, N.Y.• Kentucky Ball and Roller Bearing Co. • Louisville, Ky.

ARMSTRONG

Use the Correct . . .

ARMSTONG TOOL HOLDERS

to increase pieces, production and profits!

Because they do their work so well, without repairs, maintenance or replacement . . . because they last for years and have become as much a part of everyday operations as steel itself, the importance of using the correct type and size ARMSTRONG TOOL HOLDER for each operation, is frequently overlooked. It should always be remembered that by controlling the cutting point, ARMSTRONG TOOLS control both the productivity and efficiency of every lathe, planer, slotter, and shaper in most shops.

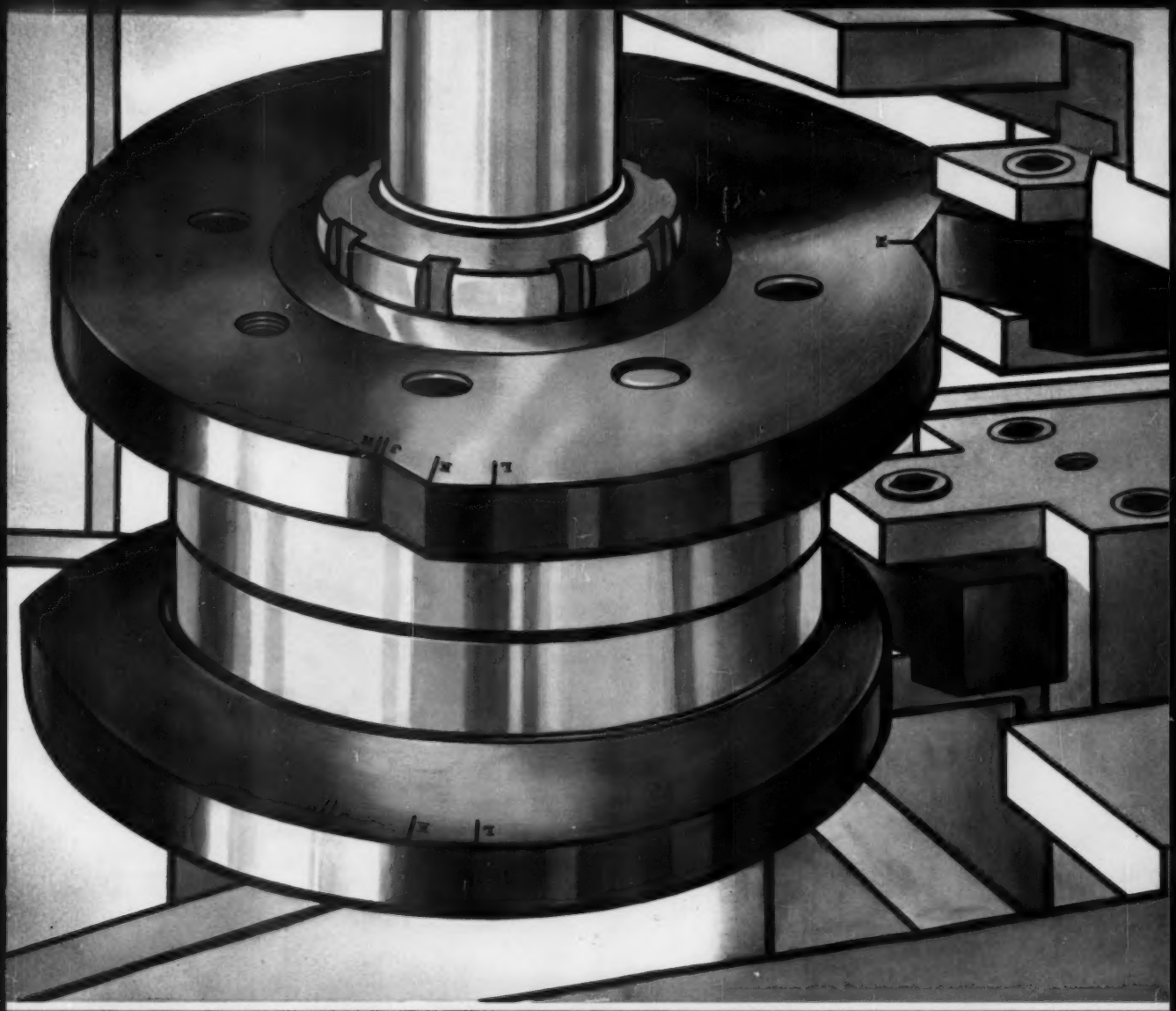
Tools so vitally situated, no matter how trouble-free, deserve periodic checking . . . checking to see that the correct size and correct type ARMSTRONG TOOL HOLDER is being used for each operation: checking to be sure that you are taking full advantage of the new additions to the Armstrong System—the special types for ARMIDE (Carbide Tipped) Cutters, others for ARMOLOY (Cast Alloy) Bits and Blades; the new "spring" form threading tools and cutting-off, etc., etc.

Write for a recent ARMSTRONG Catalog and check your tooling of each operation.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. ARMSTRONG AVE. **CHICAGO 30, ILL.**

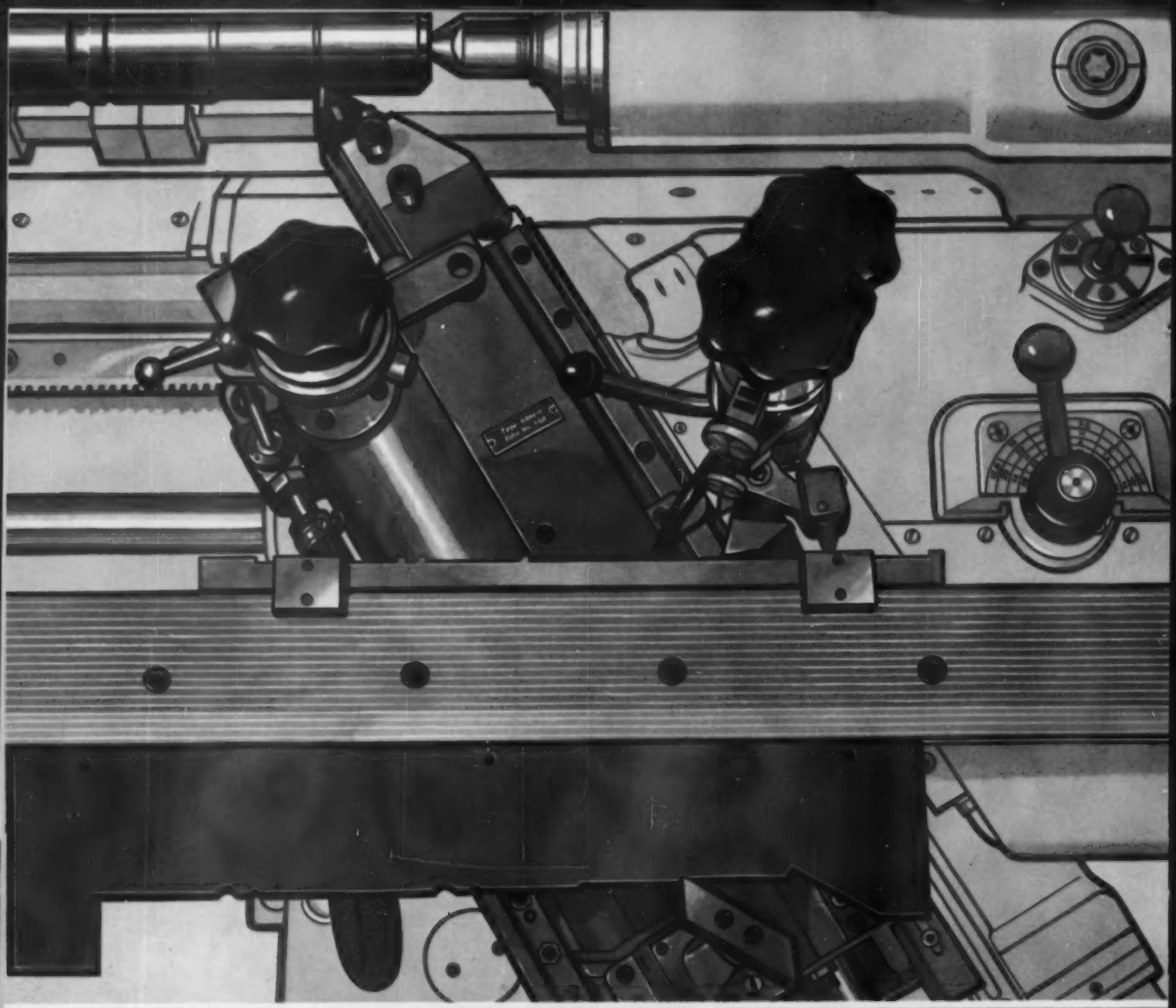


cams put the precision in precision boring

When you are working to "tenths" cams are your best method of maintaining accuracy, because cam control of the tool is *positive* control. The accuracy of parts produced on New Britain boring machines *can't* be affected by variable hydraulic pressures, ambient temperature, or play in complicated linkages.

In boring machines or *any* machine tool investment, be sure your most important requirements are met, not by gadgets, but by the fundamental design principles employed. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Precision Boring Machine
NB



New Britain +GF+ outproduces multi-tool lathes with a single tool

How can one tool outproduce several? The answer is — maintain dimensional relationships with a template or prototype instead of a multi-tool setup. This cuts tool changeover time to practically zero.

On the New Britain **+GF+** copying lathe, you can cut at maximum speeds and feeds for tool efficiency without worrying about tool wear and the delicate readjustment of several cutting tools. When the tool wears, change it, bring one dimension to size. The other dimensions have to be right. Your choice of a New Britain **+GF+** means elimination of any extra operation to bring pieces within grinding tolerances.

Machines from New Britain's three machine tool divisions incorporate the *basic principles* of more profitable production.

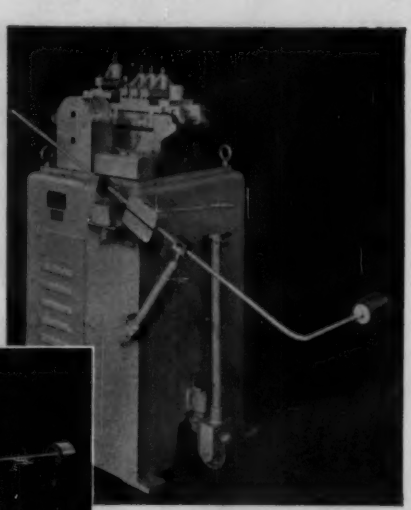
THE NEW BRITAIN MACHINE CO.

New Britain +GF+
Copying Lathe

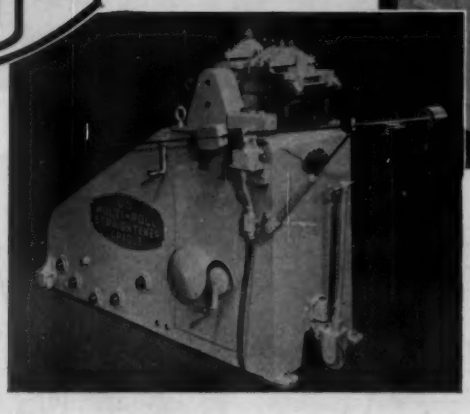
NB

USE U.S. PRODUCTS

REDUCE PRESS ROOM COSTS



Right: Model PDS-4½ U. S. Power Driven Straightener (portable type) for material up to 4½" wide, ⅛" thick. Equipped with ½ HP variable speed drive motor. Also made in other sizes.

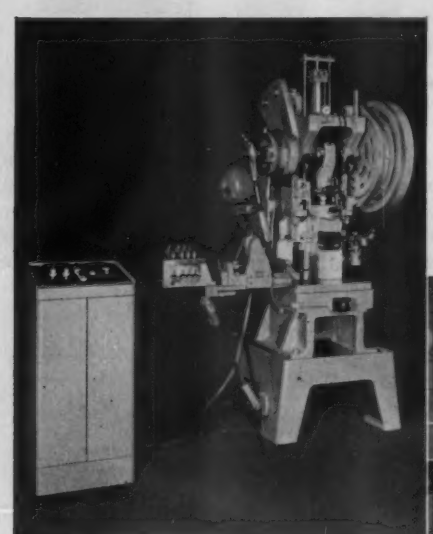


Left: Model PDS-940 U. S. Combination Coil Cradle and Power Driven Straightener (portable type) for material up to 9" wide, ⅛" thick, coils with OD up to 40". Includes 2 HP variable speed drive motor. Also made in other sizes.

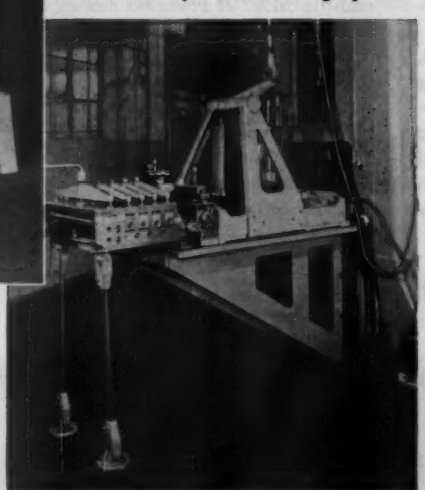
Don't allow inefficient operations to devour your profit margin. U.S. Automatic Press Room Equipment is designed and built to help you effect savings in the production of stampings.

The use of coil stock in your punch press operations should result in very definite savings, and these savings can only be completely assured by using automatic equipment in conjunction with your presses. The illustrations show just a few of the many different units included in the U.S. line for the efficient feeding, straightening and holding of coil stock.

Investigate to see if you are effecting all the cost reductions possible. Ask for a copy of Bulletin 80-A.



Above: Model SF-12 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 4½" wide. Shown mounted on a Minster B1-32 High Speed Gap Press.



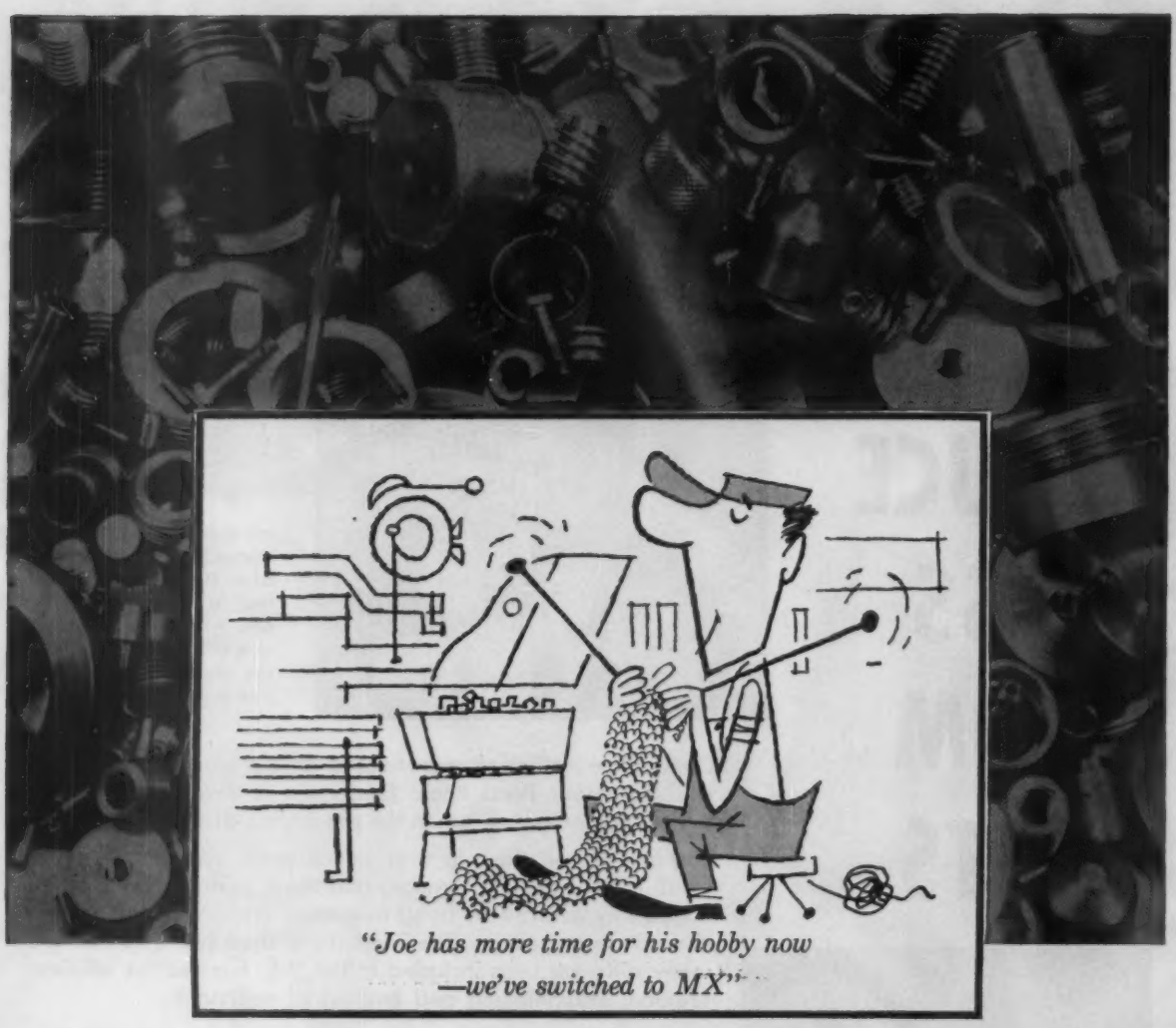
Left: Model SF-24-24 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 24" wide. Shown mounted on a Straight Side Press.

U.S. TOOL COMPANY, INC.

AMPERE (East Orange) **NEW JERSEY**

★ **U. S. PRODUCTS**

Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Wire Straighteners
Die Sets
Multi-Slides ®
Multi-Millers ®



"Joe has more time for his hobby now —we've switched to MX"

It's surprising what a difference USS Free-Machining MX Steel can make. Parts come off the machine faster—tools last longer—there's less down time—rejects are practically eliminated.

No wonder that hundreds of shops, where this high-speed, fast-cutting bar stock has been put to work, report substantial *cost savings.* These savings average between 10 and 15%; in some cases have run as high as 42%. With MX they're not only getting more parts per hour but better parts—more accurate and of finer finish—at lower cost per part.

Why not switch to USS Free-Machining MX? *It costs no more than regular screw stock,* yet it has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today.

Production-boosting, cost-reducing MX steel is produced in all the popular screw stock sizes. It is available in both Bessemer and Open Hearth grades. You can obtain it in cold-finished form from your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output... longer tool life... lower costs

USS

—when you do the job with free-machining

MX

UNITED STATES STEEL

HERE'S HOW

Namco VERS-O-TOOL

cuts costs . . . speeds production on end turning and forming

In this application 600 lever supports an hour are turned out on a vertical six-spindle automatic. Vers-O-Tool machines these steel forgings three times faster than single point tools, opens at the end of the cut, leaves no spiral marks on the work.

Write today for your copy of 48 page catalog DT-57, or ask our representative to call.

VERS-O-TOOL

LICKS PRODUCTION PROBLEMS BECAUSE:

1 Basic Vers-O-Tool design permits cutters or ground thread chasers to be changed quickly without adjustments in the head.

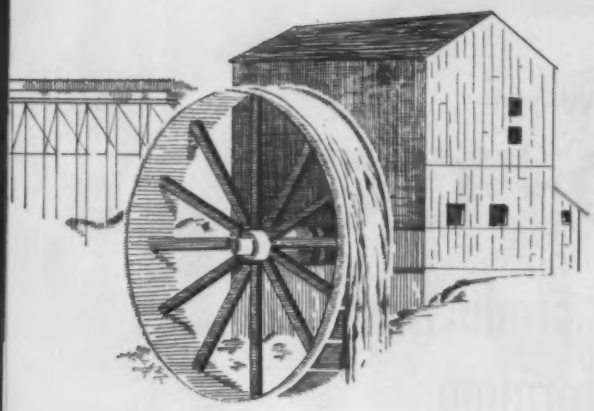
2 All settings in the blocks are made in the toolroom with a micrometer gauge—no need for trial and error run after changing or grinding.

3 Simplicity of basic design means fewer moving parts—insuring long, trouble-free performance.

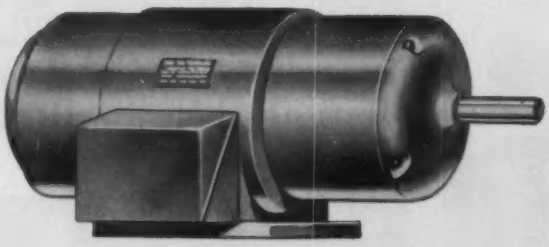
1. ROUGH TURN THREAD DIAMETER
2. ROUGH TURN STEM DIAMETER AND ROUGH FACE SHOULDER
3. FINISH TURN STEM DIAMETER AND FINISH FACE SHOULDER
4. FINISH TURN THREAD DIAMETER
5. THREAD

National Acme

THE NATIONAL ACME COMPANY, 171 E. 131st ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.



Great in its day...



BUT

WOULDN'T YOU

RATHER HAVE THE LATEST TECHNICAL ADVANCE?

Now . . . from Heller

Another great technical advance in tools . . .

"Job Tempered" Metal Cutting Band Saws

Certified by American Standards Testing Bureau to meet their standards for superior cutting — Uniform Teeth . . . Uniform Set . . . Uniform Temper*

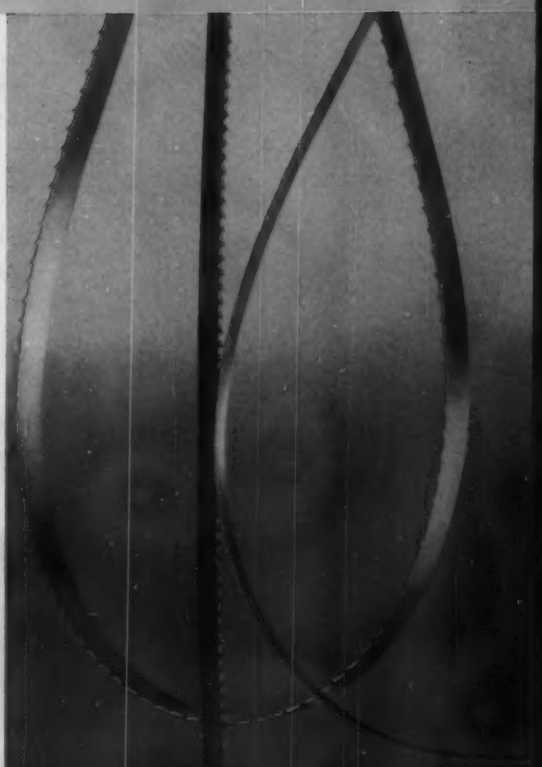
*

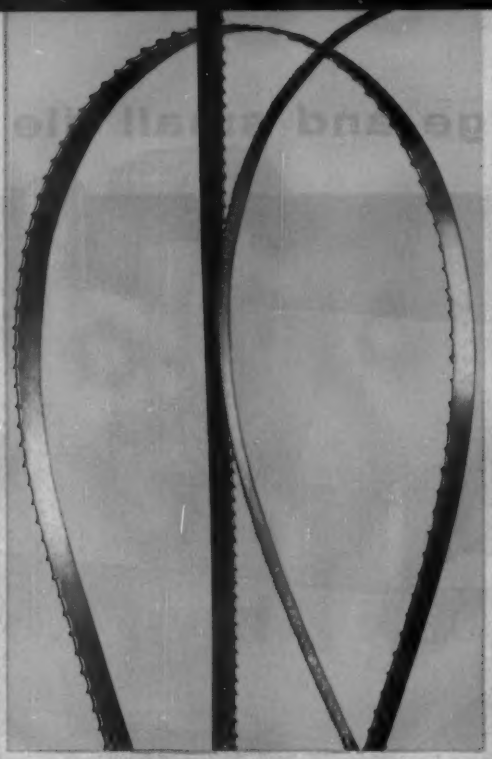
There's a new way to achieve smoother, faster cutting on band saw machines, with longer life on a variety of metals. Heller's "JOB TEMPERED" Metal Cutting Band Saws.

Heller's exclusive metallurgical and heat treating processes that have won these blades the name "JOB TEMPERED" have also earned them American Standards Testing Bureau's Certification. This is your assurance that these blades meet the three prescribed standards for superior cutting . . . uniform teeth . . . uniform set . . . uniform temper. As a result, when you use the *right* Heller Blade for the job, you're sure of superior cutting every time.

Heller "JOB TEMPERED" Hard Edge Band Saw Blades are available in all tooth shapes . . . Standard Tooth (Regular or Wavy Set), Skip Tooth and Hook Tooth. Saws are available in all standard widths and tooth spacings . . . in 100′ and 250′ coils or welded to specified lengths for use on all type machines.

High Speed Steel Band Saws are also furnished for specific applications.





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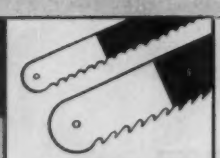
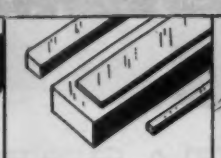
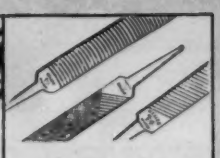


HACK SAW BLADES



FLAT GROUND DIE STEEL



FAMOUS HELLER FILES

HELLER TOOL CO. Newcomerstown, Ohio

America's oldest file manufacturer

A subsidiary of Simonds Saw and Steel Co.

Give us your toughest band sawing problems

If you've been having trouble, let us show you how the *right* JOB TEMPERED metal cutting band saw can give you better cutting, longer service and greater economy.

Here are the facts!

Heller's new catalog of JOB TEMPERED metal cutting band saws contains full description of types of blades, tooth designs and set. WRITE FOR YOUR COPY TODAY.

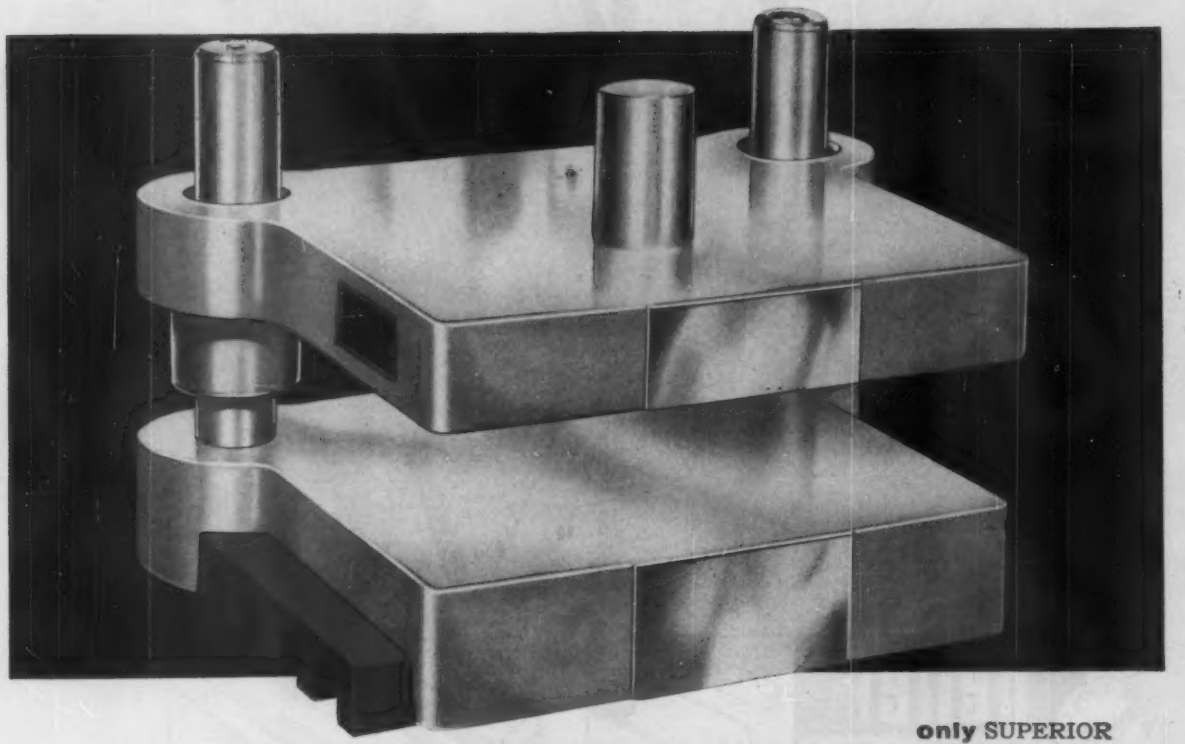
SOLD EXCLUSIVELY THROUGH

Heller Distributors

"YOUR OUTSIDE TOOL ROOM"

Heller Tools

handle large and small die sets...



SAFER, FASTER MORE EFFICIENTLY

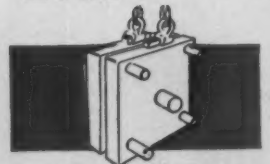
Large Sets No Longer Need Be Blocked . . .
Small Sets Can Be Lifted Without Sliding.

Features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment.

only SUPERIOR gives you these exclusive features

SAFETY FLANGE
protects fingers by providing roomy gripping space on either side of the die shoe.

LOCK-JAW LIFTING DEVICE
removes the danger of handling large die sets. Positioned to insure proper balance when the set is lifted by either chain fall or crane.



E-Z LIFT SLING CHAIN
is especially designed to fit the flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting.

For Fast Local Service Call These Superior Representatives

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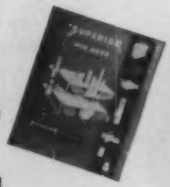
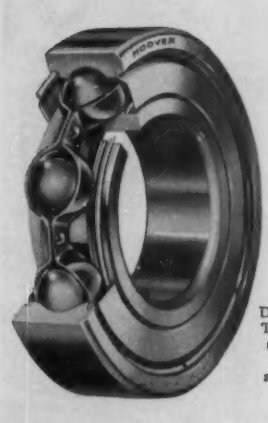
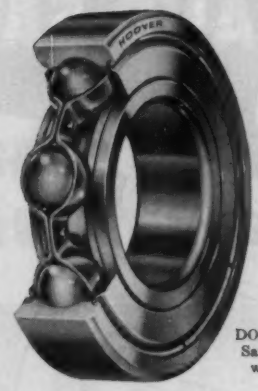


Write for FREE 24 page Catalog on Superior Die Sets and Supplies

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.



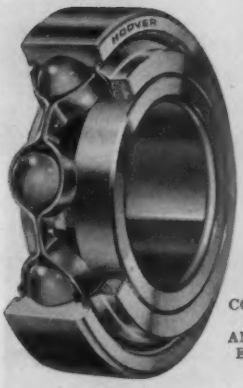
DOUBLE SEAL—
Teflon contact seal shown. Available with snap ring and with single or double seal.



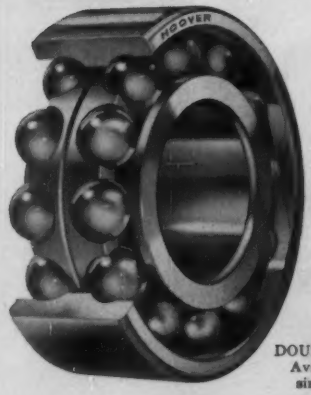
DOUBLE SHIELD—
Same sizes available with single shield.

SINGLE ROW RADIAL—
Also available with snap ring.

when you want quality



COMBINATION FELT SEAL AND SHIELD—
Either standard or wide outer ring.



DOUBLE ROW—
Available with single shield.

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Available with snap ring.

you want hoover

When you want *quality* bearings to add to the performance, long life and smooth operation of your products, you want Hoover Ball Bearings.

Hoover Ball Bearings combine the exactness of *Micro-Velvet* Lapped Balls with the smoothness of *Hoover Honed* Raceways. The result . . . top quality bearings that assure unexcelled performance —quietness—long life—and heavy load capacity.

Investigate Hoover's line of ball bearings in the light, medium and heavy series. Their microscopic precision adds up to your best buy in ball bearings. Manufacturers are invited to call in Hoover engineers for technical assistance. Write for information.

Micro-Velvet and *Hoover Honed* are Hoover Trademarks.

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Send information about

- ☐ Single Row Radial Bearings
- ☐ Bearings with Shields
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Hoover Ball and Bearing Company, Ann Arbor, Mich.

Please send information checked. Mail copy of "Hoover Handi-Book of Anti-Friction Bearings."

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10

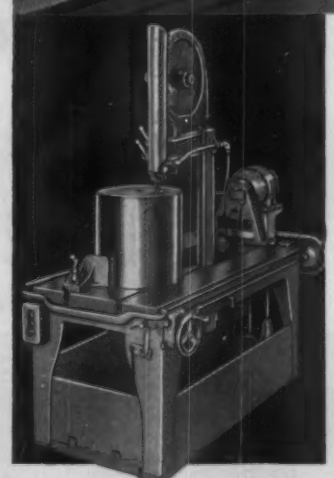
MARVEL NO. 8 BAND SAW makes a tough job EASY...

FLOOR TO FLOOR IN 5 HOURS... no special jigs, fixtures or set-up required

The versatility, simplicity of operation and unmatched efficiency of a MARVEL No. 8 Universal Metal Cutting Band Saw makes it the best all-around saw you can buy.

Take the job illustrated, as an example. Three equally spaced re-entrant cuts were required to segment a large, heavy die forging. The work was merely placed on the table between the vise jaws with the first lay-out line positioned to bisect the blade. Feed pressure was set on the direct-reading scale and the cut started. On a MARVEL No. 8, the work is always stationary and the blade is fed into the work; the cutting edge of the blade is always square with the table throughout its full feed traverse, which eliminates the need for special fixtures. The pre-set Automatic Overload-Relief Power Feed kept the blade moving into the work only as fast as it could freely remove the metal; as the vertical length of the cut decreased, the blade was automatically fed faster, thus increasing cutting speed. Upon completion of a cut, the blade was rapidly returned to its starting position by a rapid traverse handwheel located at the operator's position. Succeeding cuts were made in the same manner, with the same ease and speed.

Jobs like this aren't done every day, but they serve to emphasize the versatility of the MARVEL No. 8, a truly universal metal cutting saw. If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.



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MARVEL Metal Cutting SAWS
Better Machines–Better Blades

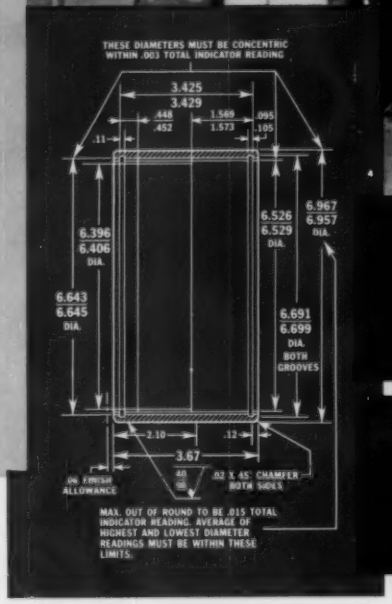
S-1302

Automobile Manufacturer produces

Repetitive Pieces to Close Tolerances with

BULLARD MULT-AU-MATIC Type "L"

At one of the nation's largest automotive plants, a number of Bullard Mult-Au-Matics, Type "L" are employed to produce automatic transmission parts. According to the Process Engineer "The transmission is the most precision piece of equipment in the entire car — with many moving parts fabricated to close tolerances."



If you have need to manufacture to exacting tolerances it will pay you to investigate the many advantages offered by Bullard Mult-Au-Matic, Type "L".

Send for catalog today

THE
BULLARD
COMPANY
BRIDGEPORT 9, CONNECTICUT

THE BULLARD COMPANY
286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT
Please send me a copy of the
NEW MULT-AU-MATIC, TYPE "L" CATALOG

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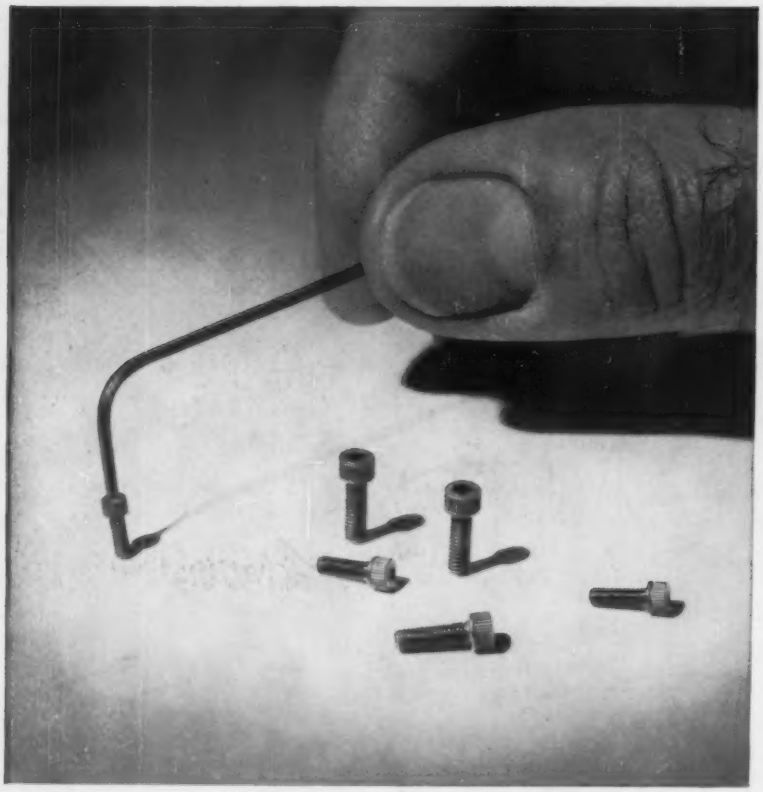
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Miniature screws aid standardization of small devices



Standard UNBRAKO miniature socket head cap screws are available in sizes # 0, # 1, # 2 and # 3, in heat treated alloy steel or stainless steel, at your authorized industrial distributor's. Standard lengths range from ⅛ to ½ in.

Tiny close-tolerance Unbrako screws available in standard sizes

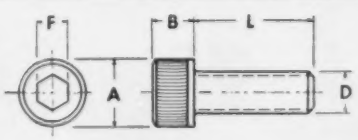
New economies in the design of space-saving miniature equipment are possible with these UNBRAKO miniature socket head cap screws. Manufactured to timepiece precision, available locally, they save the costly necessity of designing special screws to fasten tiny parts in compact units. They're ideal for use in typewriters, calculators and computers, servomechanisms, electric and electronic equipment—and in countless other small, intricate devices where maximum reduction in bulk and weight is required with no sacrifice in strength of individual components or assemblies.

Fingers grip the knurled heads on these tiny screws positively for easy handling and fast assembly. Uniform hex sockets assure maximum wrenching torque. Controlled fillets under the heads prevent shearing of the heads. Threads are fully formed for maximum strength and exact fit. Extremely accurate head diameters permit their use in countersunk holes, saving weight by reducing the length of the screw required and making flush designs possible.

These standard UNBRAKO miniature screws are available at your authorized industrial distributor's. See him today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 1, Pa.

HEAT-TREATED ALLOY STEEL

Class 3 Fit Standard



Diameter		Threads per Inch NC	Threads per Inch NF	Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per 1000 in Pounds
#0	A .104		80	⅛		2.0	.152
	B .060		80	3/16		2.0	.182
	D .060		80	¼		2.0	.210
	F .050		80	⅜		2.0	.265
#1	A .118		72	⅛		3.5	.27
	B .073		72	3/16		3.5	.32
	D .073		72	¼		3.5	.37
	F .050		72	⅜		3.5	.47
#2	A .140	56		3/16	6.0		.42
	B .086	56		¼	6.0		.50
	D .086	56		⅜	6.0		.58
	F 1/16	56		½	6.0		.70
#3	A .161	48		3/16	8.5		.59
	B .099	48		¼	8.5		.70
	D .099	48		⅜	8.5		.81
	F 5/64	48		½	8.5		1.03

Standard Screws are threaded to the head. Special materials, lengths, and threaded lengths are available. One "High-Titan" UNBRAKO hex key is included with each package of 100 screws.

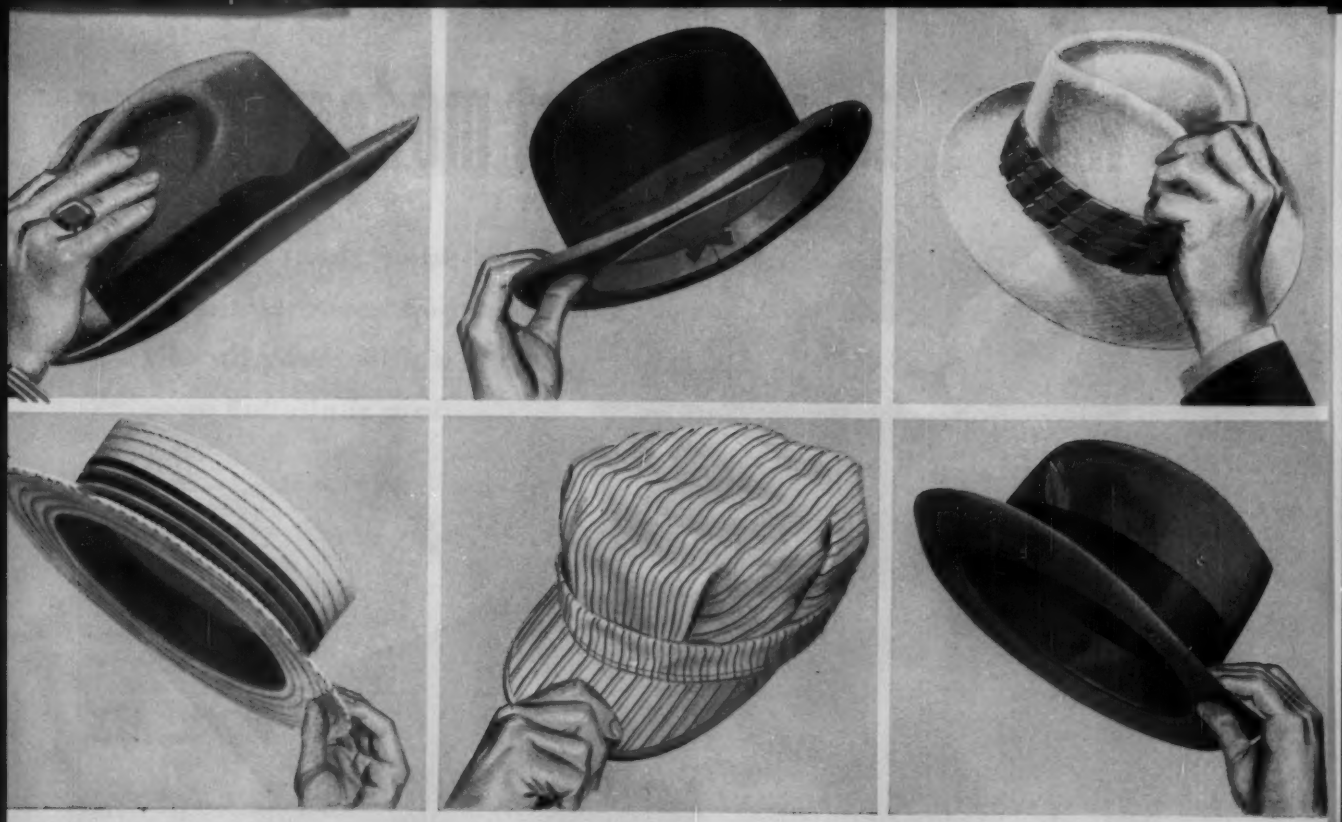
UNBRAKO®

SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA



Why hats are off to CIMCOOL...

. . . because CIMCOOL® has become, in just a few years, the largest selling cutting fluid in the world. And sales of this radically new and different coolant are continuing to climb because CIMCOOL Standard Concentrate has two big advantages over old-fashioned cutting fluids:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

We'll be happy to supply information on the many specific advantages of CIMCOOL Standard Concentrate—or details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll have one of our Cincinnati Milling-trained machinists call on you —without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL	**Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.
CIMCOOL	**Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.
CIMPLUS	The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.
CIMCUT	**Concentrates** — For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.
CIMCOOL	**Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.
CIMCOOL	**Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

see what America's most modern power

SHEAR USERS EVERYWHERE TELL THEIR STORIES OF NIAGARA BENEFITS

(3 of 19 Photo-Reports shown in Niagara's new Bulletin 69G)

"an exceptional machine value"
— World's Largest Trailer Mfr.

"For over 10 years we have never had any downtime for repairs and maintenance."
— V-Belt Pulley and Caster Mfr.

"High quality of accuracy with the utmost in speed and performance"
— Midwest Road Machinery Mfr.

NIAGARA

squaring shears can do for you!

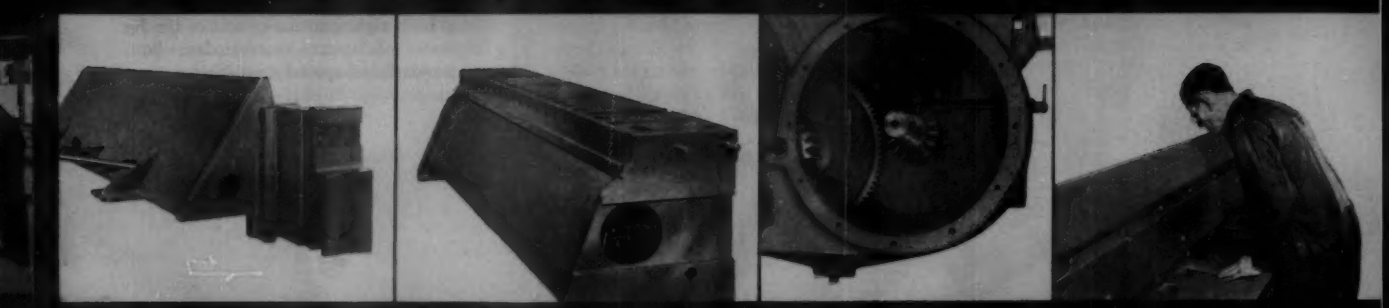
Speed that spells peak productivity! Accuracy for cutting within micrometer tolerances! Ruggedness to stand the gaff on stiffest assignments! They're all yours with a Niagara Power Squaring Shear. New, fact-filled 74-page Bulletin is profusely illustrated to show you how and why:

From mass producers, fabricating plants, steel warehouses and sheet metal shops comes written evidence of the superiority of Niagara Underdrive Squaring Shears on jobs of every description. *No other shear can match Niagara's record for cutting accuracy, speed and downright economy of operation.*

For a photo story of the many tangible ways in which a Niagara Power Squaring Shear can boost hourly output, improve quality and slice maintenance costs in your plant, make sure that you receive Niagara's newly-published Bulletin 69G by mailing the coupon below. Presenting the greatest shear story ever told this 74-page document will give you a close look at Niagara Shears in numerous applications . . . the *closest* look you have ever had at *any* shear, next to having it on your own floor! It will show you feature-by-feature why a Niagara Shear is far ahead at every point of comparison . . . and why it pays to look to America's oldest leading shear manufacturer for the most profitable answers to *your* requirements.

NIAGARA-DEVELOPED FEATURES PROVIDE THE ULTIMATE IN MODERN SHEAR PERFORMANCE

(Here's a glimpse at just a few of many. See them ALL in new Niagara Bulletin 69G)



Fully Closed Box Type Construction

Massive Bed Designed for Super Strength

Instantly Engaging Multi-Jaw Clutch

Powerful, Self-Compensating Holddown

YOURS FOR THE ASKING...

the most comprehensive shear bulletin ever published!

Months in preparation, this fact-filled bulletin now gives you valid, inside facts on the nation's top line of power squaring shears. 74 pages! 141 revealing photographs and illustrations! Specifications for nearly five dozen standard models! Capacities: 16-gage to 1" mild steel. Cutting lengths: 4 to 20 ft. Make sure that you receive a copy at once. Mail the attached coupon today.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

MAIL your new Underdrive Squaring Shear Bulletin 69G to us immediately.

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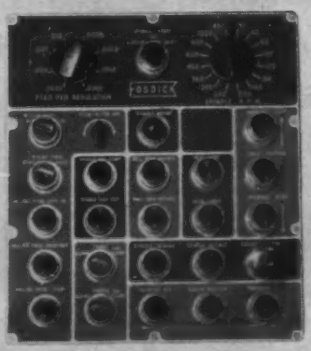
CITY _____ ZONE _____ STATE _____

AM

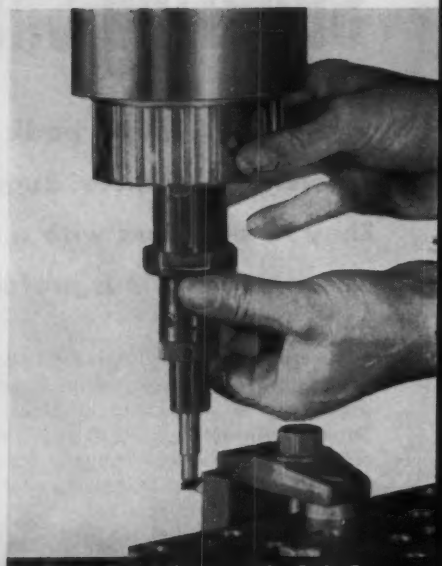
MEASURE

Dial dimension direct from print. There are two sets of direct-reading drum dials, one for longitudinal, the other for transverse position. Operator simply sets dials so that numbers on dials correspond with numbers on blueprint. Simple. Direct. Precise.



POSITION

Press two buttons, one for longitudinal, one for transverse positioning. Table, and work, are automatically positioned, and clamped under the tool, accurate to ± .0001"! Accuracy is dependent upon highest-quality gages, not upon screw threads. Sensitive .0001 Dial Indicators maintain a positive check at all times.



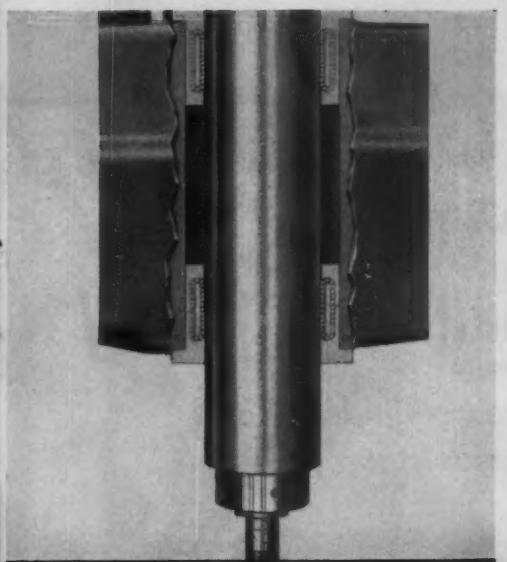
CHANGE TOOLS

Tool changing takes less than 10 seconds, with BF spindle. Can be accomplished while table is positioning. Hole sizes are repeated within ± .0001", without resetting tools! High-precision tool holder is built right into the spindle of the Jig Borer. Adapters accommodate both standard and special-sized tools.

FOSMATIC JIG BORER

AUTOMATIC POSITIONING

DIRECT DIMENSION MEASURING



BORE

Push-button precision boring. For finish boring, change tools quickly, then bore at touch of button. The hardened alloy steel quill rides on 800 preloaded balls mounted in precision bushings located permanently at top and bottom of head—as close as possible to spindle nose for maximum rigidity. Spindle is guaranteed not to exceed .0002" runout at the end of 12" proving bar!

MEASURE - POSITION - CHANGE TOOLS START BORING . . . ALL IN SECONDS!

hole size and position accurate to ± .0001.

The new Fosdick Jig Borer can be used for the finest toolroom boring or for production of precision holes. Like the scores of Fosdick Jig Borers in plants throughout the United States, this machine will perform consistently to ± .0001" . . . in measured table and saddle position as well as hole size.

The Fosmatic Jig Borer is extremely simple to operate. Changing of feeds and speeds, all movements of the table, saddle, and head can be accomplished by push button. Spindle is started and stopped by lever on head. Machine may be equipped with or without automatic positioning. Can be equipped for numerical control with either tape or card systems.

Other features available as extra equipment include Milling Feed, Rapid Traverse to Quill, coolant system and reversing motor for tapping.

Ask for Fosmatic Jig Borer Bulletin, JB-A.

Users tell you . . .

How Norton wheels cut O.D. grinding costs and improve quality

Here's the "Touch of Gold" to give your cylindrical and centerless grinding great advantages

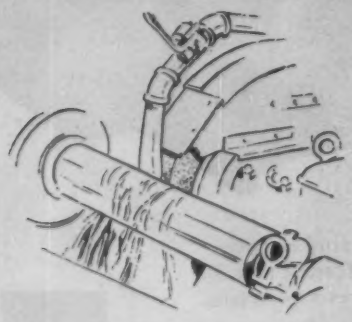
Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per wheel and dressing . . . easier dressing, with less wear on diamond or crushing roll.

Those are typical benefits reported by Norton G Bond and BE Bond wheel users all over the country — concerning every type of O.D. grinding.

It's all because both G Bond and BE Bond are so particularly well adapted to the needs of cylindrical and centerless grinding. Wheels made with them hold each abrasive grain just long enough for maximum cutting action — and outperform all other wheels in many grinding operations, precision or semi-precision. The new Norton "44" ALUNDUM abrasive is proving to be the most outstanding non-premium-priced abrasive for many O.D. grinding jobs.

Here we can show just a few of the on-the-job photos and facts passed on to us. Look them over — and note how these wheels can add the "Touch of Gold" that will boost your own product quality and profits.

Typical Performance Reports on "44" ALUNDUM* Abrasive



CYLINDRICAL GRINDING

A WISCONSIN PLANT, grinding 2" to 4" diameter steel shafts, 12" length, reports 44 ALUNDUM wheels (44A54-KVBE) cut faster and cooler with no sacrifice of wheel life, compared with best previously used wheels.

A MICHIGAN PLANT, grinding miscellaneous high speed steel bolt heading dies finds 44 ALUNDUM wheels best. Reasons are more pieces per dressing, cooler cutting action and 30% longer wheel life than formerly used wheels.

A NEW JERSEY PLANT found a 44 ALUNDUM wheel (44A36-MVBE), plunge grinding different steel parts, gave many more pieces per dressing and averaged 15% longer life than wheels they used before.

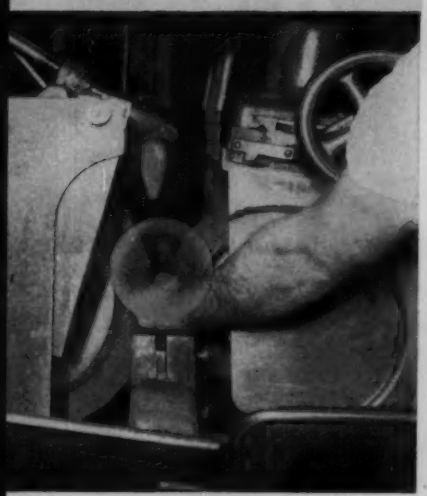
CENTERLESS GRINDING

A MICHIGAN PLANT, of the smaller jobbing types, grinding all kinds of materials. They prefer 44 ALUNDUM wheels (44A801-NVBE) for versatility, less dressing and faster cutting — including 10-hour completion of a job which used to take 14 hours.

AN OHIO PLANT removes .008" on the rough grind and .003" on the semi-finish grinding of No. 1010 steel crankshaft pins, ¾" diameter x 4" length. While standard wheels gave them an average of 600 pieces per dressing, they report a 44 ALUNDUM wheel produced 1,000 pieces, by retaining its sharp cutting face longer. All stock was removed in one pass, compared with two passes formerly required.

ANOTHER MICHIGAN PLANT, of large size, tested a 44 ALUNDUM wheel in grinding hardened steel tappets. They report more pieces per dressing, faster cut and less burn than ever obtained before.

"G BOND WHEELS LAST US UP TO 40% LONGER," reports this centerless grinding customer. He found that wheel life increased profitably because this greatly improved vitrified bond breaks down so evenly. Workpieces are tapered shank vanadium steel spindles, 10" long with ¼" diameter — plunge ground to remove an average of .045".



"WE NOW GET 800 PIECES PER DRESSING with G Bond wheels, as against 500 pieces with previous wheels. Also, we get 50% longer wheel life, a finer finish, and the shoulder holds up much better." That's the report on this plunge-cut centerless grinding job. Work is a ¼" diameter, 1" long stud from which .012" is removed, to .0005" tolerance and 20 microinch finish.

"WE INCREASED PRODUCTION RATE 35% with G Bond wheels, besides greatly improving finish." These valuable "Touch of Gold" advantages are reported on a cylindrical grinding job calling for .025" stock removal from stainless steel tubing. The operation is also on a Norton machine — a reminder that only Norton offers you such long experience in both grinding machines and grinding wheels, to help you produce more at lower cost.

ASK YOUR NORTON DISTRIBUTOR for further proof of how Norton O.D. wheels can bring you best possible results. He'll gladly arrange a test in your plant. Distributors in all industrial areas listed under "Grinding Wheels" in the yellow pages of your telephone book. Behr-Manning Division, Troy, New York. *Export:* Norton Behr-Manning Overseas, Inc. **For information write Norton Company, Worcester 6, Mass.**

W-1772

NORTON

ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS:
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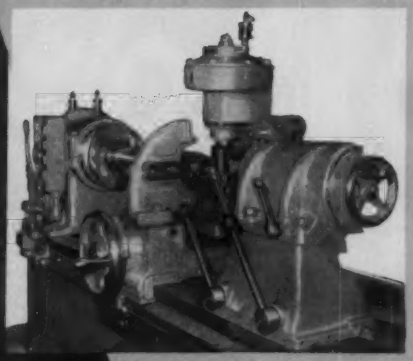
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS:
Coated Abrasives • Sharpening Stones
Behr-cat Tapes

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

THE SH SPLINE HOBBING MACHINE

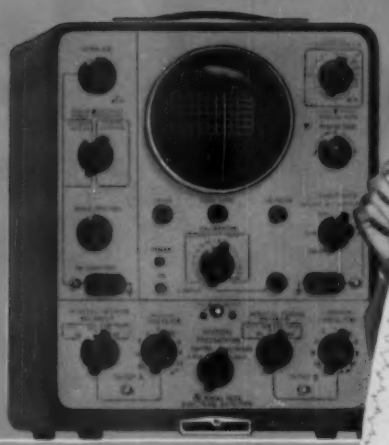


HOBS UP TO 144" BETWEEN CENTERS

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

A woman's place is in the home?



HEWLETT-PACKARD'S NEW, MODEL 150 OSCILLOSCOPE

Not any more... and Hewlett-Packard Instruments project them into highly technical occupations!

But no matter who operates them, it is logical that Hewlett-Packard's ability to design their complex, electronic instruments would be reflected in their demand for efficient and economical assembly methods.

That's why, almost without exception, Hewlett-Packard depends on Sciaky resistance welding techniques and equipment to satisfy their rigid specifications for fastening—aluminum cases of all sizes and shapes . . . complex chassis assemblies . . . even precision variable condenser stators and rotor assemblies.

Putting the profits back into manufacturing is the Sciaky concept of design. So, whether or not *you* make instruments—assemble the metal pieceparts of *your* product to best advantage with Sciaky resistance welding techniques—like Hewlett-Packard does!

SCIAKY®

Largest Manufacturers of Resistance Welding Machines in the World

Maybe the details of Hewlett-Packard's operation on the next page will help you improve your own

• **OSCILLOSCOPE CHASSIS**—resistance welding 12 piece parts of 14 and 12 ga. 52S aluminum; 80 spot welds per chassis; 40 chassis per day with two welders.

• **SIGNAL GENERATOR CABINET**—resistance welding 8 piece parts, 14 ga. 52S aluminum and cast bezel; 55 welds per cabinet; 16 cabinets per hour with two welders.

• **VARIABLE CONDENSER**—projection welding 6 piece parts to high accuracy in one stroke; 350 condensers per day with two jigs, one operating, one loading.

Sciaky Resistance Welding Techniques increase production 150%

Better product quality, easier assembly are additional benefits

For Hewlett-Packard Company, Palo Alto, California, leading electronic instrument manufacturer, Sciaky Resistance Welding Techniques have provided four basic cost cutting production advantages—

1. **Increased production—as much as 150%.**
2. **Elimination of fit-up problems of riveting.**
3. **Simplified quality control procedures.**
4. **Adaptability of equipment to pilot runs without costly tooling.**

So successful have Sciaky Resistance Welding Techniques been —even on jobs where other equipment failed—that Hewlett-Packard is now designing all new products for Sciaky Resistance Welding. And old products are being redesigned to take advantage of this economy, too.

Described at the right are a few of the jobs being done at Hewlett-Packard with Sciaky Resistance Welding Techniques *designed to put the profits back into manufacturing.* These and other jobs are described in greater detail in "Resistance Welding at Work," Vol. 5, No. 2. Write for your free copy today.

Largest Manufacturers of Resistance Welding Machines in the World

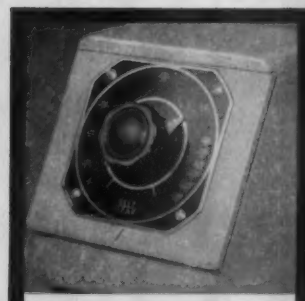
SCIAKY®

Sciaky Bros., Inc., 4928 W. 67th Street, Chicago 38, Illinois POrtsmouth 7-5600

You get
top value per dollar
with a Hendey No. 2E Lathe

timesaving control features

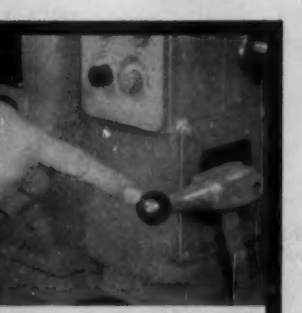
make skilled hands more productive!



Operator quickly and easily adjusts speed control dial (with machine under load) to most efficient cutting speeds. Electronically controlled drive gives limitless number of speeds, between 15 and 1500 rpm.

This lever provides faster, easier control of the tool when cutting threads. Speeds operation when chasing odd threads which cannot be picked up on the thread-chasing dial, and on short-run jobs.

Speeds of 30 to 1500 rpm are available on belt drive. Back gears provide speeds of 15 to 187 rpm. Belt with teeth assures positive rotation. Drive pulley is mounted independently on anti-friction bearings.

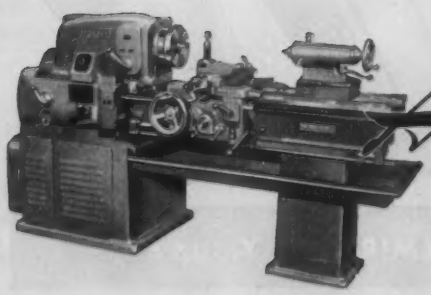


Electric brake stops spindle within two seconds, even from the highest speed. There's no coasting or waiting between cuts; spindle is started, stopped, and reversed from preset speeds quickly, easily.

For general-purpose turning not requiring a geared drive, the Hendey No. 2E gives you top value per dollar . . . with more torque at low speeds . . . a more efficient drive and a more sensitive speed control . . . more of the versatile features you need to speed your jobs and control your costs.

This lathe is easy to operate at the most efficient cutting speeds. You get an infinite range, right at your fingertips. It's the only 14 in. general-purpose lathe that can be equipped *in minutes* with an optional tracer attachment for efficient contour turning on short-run jobs. In the moderate price class, the Hendey Model No. 2E pays for itself quickly out of savings. Contact your Hendey dealer for details and complete specifications.

for precision with production buy Hendey



Hendey **machine division**
BARBER-COLMAN COMPANY
21 Loomis St., Rockford, Illinois

BARBER COLMAN ®

HARDINGE
ELMIRA, N.Y.

HARDINGE Sjogren Chucks

Quality at Low Cost

HARDINGE-SJOGREN Speed Collet Chucks for tool room lathes, engine lathes and grinders.

Available in Five sizes to suit your work requirements: 1 1/16", 1 3/8", 1 3/4", 2 1/4" and 3 1/2" Capacity

1⅜" Capacity
Plain Back
$91.00

1⅜" Capacity
D1-6" Cam Lock
$103.00

1⅜" Capacity
No. 1 Taper Key
$107.00

HARDINGE
ELMIRA, N.Y.

HARDINGE Low Cost Steel Collets

Maximum efficiency — Pay for only what you use. Records show that 82% of all sizes used are standard 16th sizes.

Buy only the sizes you use — Hardinge Collet stocks are available in Hartford, New York, Philadelphia, Baltimore, Rochester, Dayton, Detroit, Chicago, St. Louis, Minneapolis and Los Angeles. Also, Toronto and Montreal, Canada.

HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

It MUST have been good!

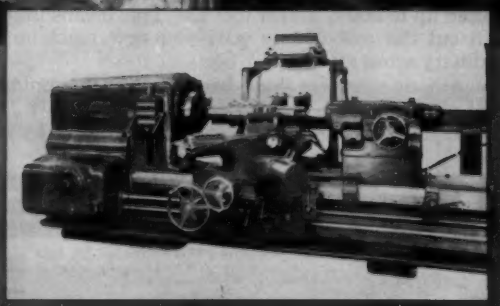
There are times when expressions speak louder than words.

Here's a group of distinguished steel mill roll executives watching a demonstration on a 26" Capacity "AMERICAN" Hydraulic Roll Lathe—judge for yourself whether or not they are satisfied with what they saw.

These machines are performing "miracles" in savings in many of the best known roll shops in the country. They have introduced a brand new machining technique that has revolutionized the art of roll turning. They reproduce work shapes from a template faithfully and accurately not only on steel mill roll bodies and necks, but on such work as spindles, motor shafts, valve stems, step shafts, piston rods, axles and a wide variety of chucking work having irregular contours.

Evidence from hundreds of installations proves beyond a shadow of a doubt their leadership as top-flight cost reducers. Was there ever a time when cost reduction was more urgently needed?

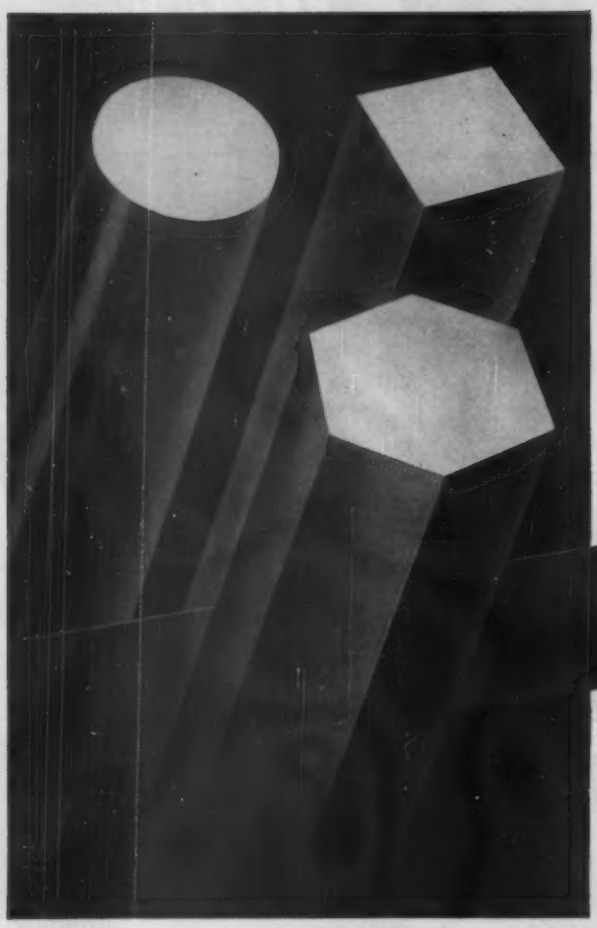
If it's proof you want just drop us a line—no obligation.



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

USS MX—fastest free-machining screw stock—at no extra cost!



NOW "GRADE MARKED" FOR YOUR CONVENIENCE!

Rounds • Hexagons • Squares

- The grade of each lot is clearly marked on the seal!
- Takes the guesswork out of bar selection—lessens the chance of mistakes—saves time all along the line!
- Another reason why U. S. STEEL SUPPLY is the place to buy!

Quick delivery from our nearest warehouse puts you in position to cash in on many advantages of this remarkable screw stock!

If you are interested in turning out more parts per hour, switch to USS MX Free-Machining Screw Steel. This is possible because MX will take cutting speeds up to 50% higher than with regular Bessemer grades. This faster machinability has enabled hundreds of shops to boost production from 10 to 50%. And they have gotten up to 200% longer tool life. This means that MX will cut the cost of any part you now machine from ordinary screw stock.

You pay no more for these benefits. By increasing the rate of production, MX lowers the cost per part . . . by prolonging tool life, MX reduces down time . . . by assuring better finish, MX eliminates extra finishing operations . . . and by providing closer dimensional accuracy, MX helps to eliminate rejects.

U. S. Steel Supply can give you quick delivery on this remarkable screw stock in both Bessemer and Open Hearth Grades . . . in all the popular sizes and shapes. In addition, each lot in your order is neatly strapped and the seal identifies the lot as to grade. This is what we mean when we say "Grade Mark Service." It saves you time in identifying and stocking screw stock you buy from U. S. Steel Supply. All orders filled from warehouse nearest point of delivery.

U. S. STEEL SUPPLY

DIVISION

General Offices: **208 So. La Salle St., Chicago 4, Ill.** **Warehouses and Sales Offices Coast to Coast**

UNITED STATES STEEL

DROODLES

by ROGER PRICE

Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

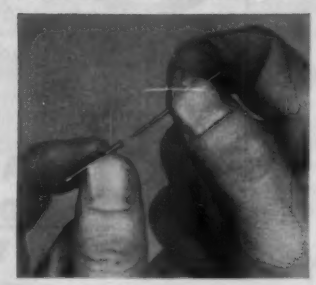
Table Model TC-14
(Vertical Inspection)

"T-SQUARE FOR WOOZY DRAFTSMAN"

My designing uncle, Claude, invented this while working for the Biggs Chest-Wig Corp., makers of "Thorax-Thickets." The idea hit him during the annual Company Party. Unk, a fast man with a grape, was in rare form. He had just defenestrated the Accounts Receivable ledgers, and was launching into his famed take-off on Old Man Biggs, when the latter appeared. During the ensuing conversation, Claude bent his T-square over the Biggs cranium, and mankind was enriched by a new invention. Since then, C. has gone on to bigger and better things. He now owns a distillery, making "Tipple-Tot," the children's whiskey. A grand idea . . . wish I'd thought of it first!

Another thing I should have thought of first is the Optical Comparator, made by my friends, Jones & Lamson. The J&L O.C., as I familiarly call it, is a marvelously versatile instrument that is used for measuring and inspecting all sorts of parts and objects of various sizes and shapes. It is speedy and accurate (to .0001") and cuts inspection costs to the bone. The J&L Comparator is equally suited for both production-line and job-shop work, and it performs inspections that just aren't possible by any other method. Get the full details . . . send this coupon *today!*

JONES & LAMSON OPTICAL COMPARATORS *On the Job...*



A customer writes: "The J&L Optical Comparator has enabled us to reduce costly man-hours in inspection time. We are also able to accurately inspect work that previously would have been impractical. A typical case: We had a 1,840,000 piece job requiring accurately drilled .043 dia. holes ⅜" deep in 1020 steel. Drill "breakage" was excessive and hole straightness difficult until the Comparator enabled us to easily inspect all drills for precisely ground points and .0005 per inch straightness."

"The originator of machine tool standards in optical inspection"

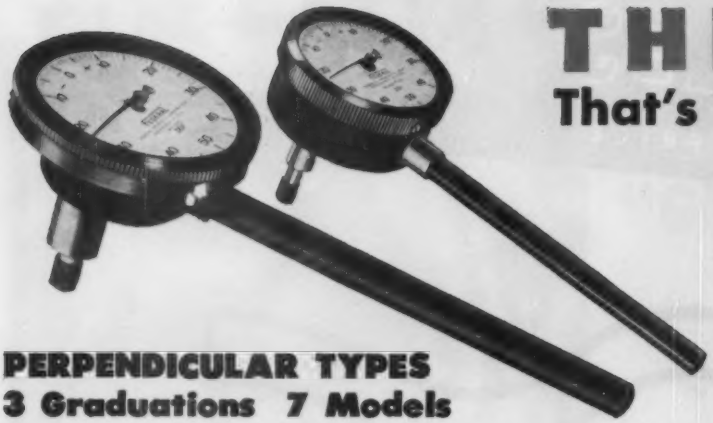
JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710. 502 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____



THE MOST
That's Why More People

PERPENDICULAR TYPES
3 Graduations 7 Models

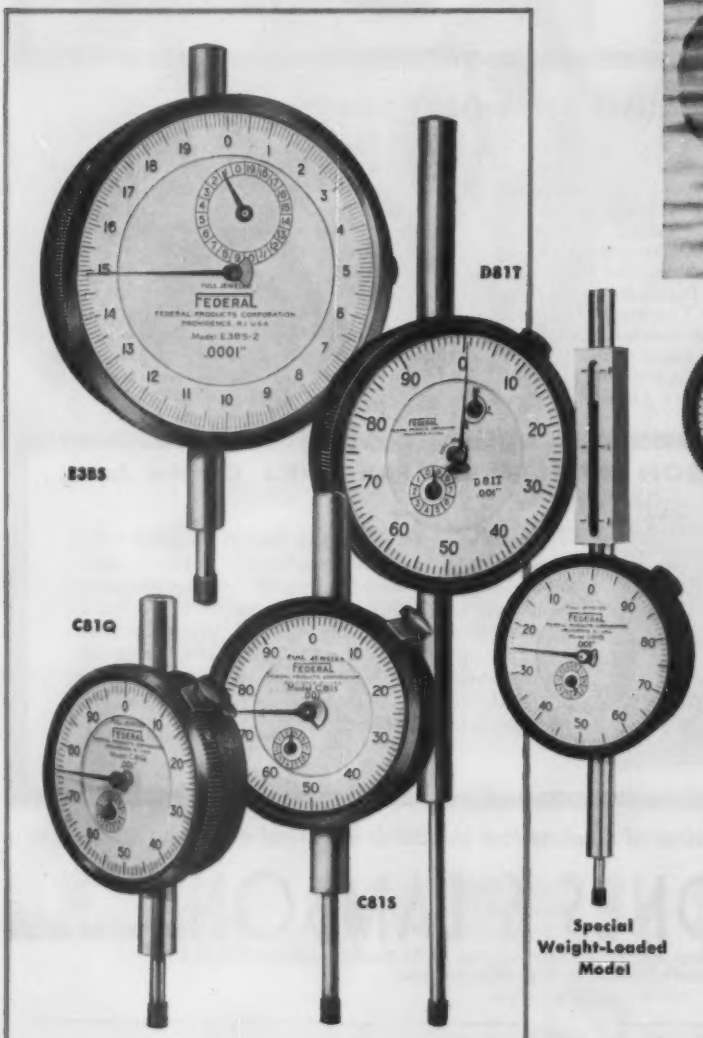
You get the greatest of all selections from which you can pick the right instrument for your job.

You get the benefits of doing business with a company which consistently offers improvements and new ideas.

You get a known accuracy and dependability built up over years of development and experience.

You save the confusion of stocking and maintaining several different makes of instruments.

LONG RANGE MODELS



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Completely Sealed

Completely protected from coolant, oil, oil fog, and water. Also protected from dust. Cushioned movement. Extra heavy case for rough usage. Extra strong mounting. Selection of 4 graduations, 6 ranges. A Federal "new".

SHOCKPROOF
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Proven winners in competitive endurance tests. Shock is absorbed and prevented from reaching sensitive and precisely aligned parts. No additional friction. No sacrifice in accuracy.

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Yours for the asking
Write

for YOUR MONEY

Standardize on—

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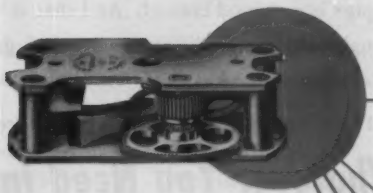


UNIT MOVEMENT

Assures Perfect Alignment
Positive Adjustment — Rigidity —
High Accuracy . . .

Maintenance men tell us repeatedly it is the easiest to repair.

FIVE SIZES
LOW FRICTION
ANY GRADUATION
PLAIN OR JEWELED

LONG LIFE
HEAVY DUTY

Another new in Federal Indicators (H Model). The best you can buy in every way. A really rugged, shockproof, maintenance-free, lifetime Dial Indicator that withstands more impact. Low maintenance, greater accuracy 16% to 25% less friction. Four sizes. Furnished in Regular, Wetproof and Long Range models.

Whatever you need in Dial Indicators and Accessories you can get from Federal (direct from our Branch Offices too.) And, you'll be in line for new developments later. If you haven't a catalog, tell us if you want one.

FEDERAL PRODUCTS CORPORATION
7122 EDDY STREET — PROVIDENCE 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

SEE ALSO NEXT PAGES

PRECISION REQUIRES SPECIAL

and Gets it with FEDERAL

OVER 12 TYPES of HOLE GAGES in all sizes

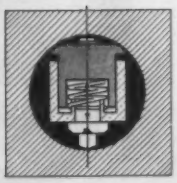
If you are not kidding yourself about Precision you know you have to gage a dimension a certain way if you want an accurate measurement.

That's why good gage users know that just *any* gage is *not* good enough. And that is why Federal makes so many different types of gages of the same general kind.

There are all degrees of accuracy required and

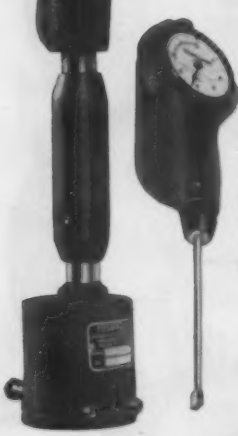
Whatever You Need in Gages

Ask **FEDERAL** *First*



Model 1250 Series Positive Centralization
Set directly to Gage Blocks or Micrometers 4 sizes cover all diameters

Model 149P I.D. Caliper Gage
(also Model 49 O.D. available) Stock and Special Models of All Shapes



Model 1203 .122"-.250" Diameters
Model 1204 .250"-.506" Diameters

Model 1242 Series (Two-contact)
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Many Other Types.

Send for Catalog.
Illustrates the most extensive line available.

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Model 88 Series
Shallow Hole, Bore or Shoulder I.D. O.D. Diam. Adjustable and Single Dimension Models

Model 36 Series
Bench Type Hole and Outside Diameter Gages

SEE ALSO PRECEDING PAGES

Gages Can Be Modified Specially to Suit

TREATMENT

DIAL GAGES

Federal takes the care to obtain that accuracy.

And some need more gaging pressure, and some less, and some need narrow anvils and some need wide anvils. Some want to gage just a hole diameter and some want to know if it's round or if it tapers.

It's easy to find the gage you need to check a dimension the right way — get in touch with us. Do it now.

Federal Products Corporation
7122 Eddy Street Providence 1, R. I.

OVER 12 TYPES of SNAP GAGES in all sizes

Model 1000 Series

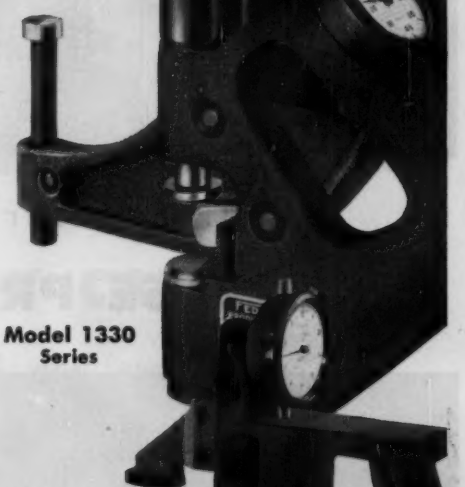
Model 75 Series

Model 65 Series

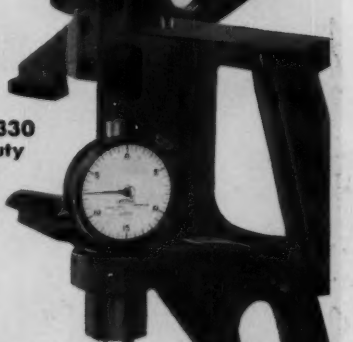
DEPTH GAGES

All types — knife edge, long range, special anvils and special types.

Model 75P-10 Adjustable



Model 1330 Series

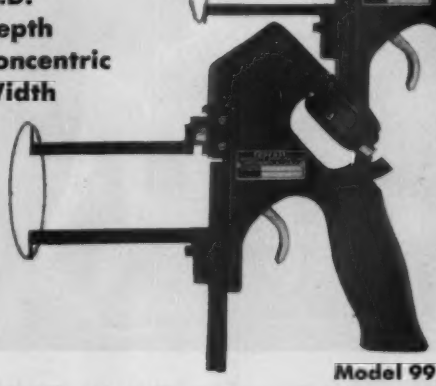


Model 1330 Heavy Duty Series

GROOVE GAGES

I.D.
O.D.
Depth
Concentric
Width

Model 99P-10



Model 99P-11

Model 99P-12

Model 264 Series

Model 1340 Series

On any material, any job . . .

INCREASE PRODUCTIVITY, CUT UNIT

Output boosted 20%-30% with Grade 860

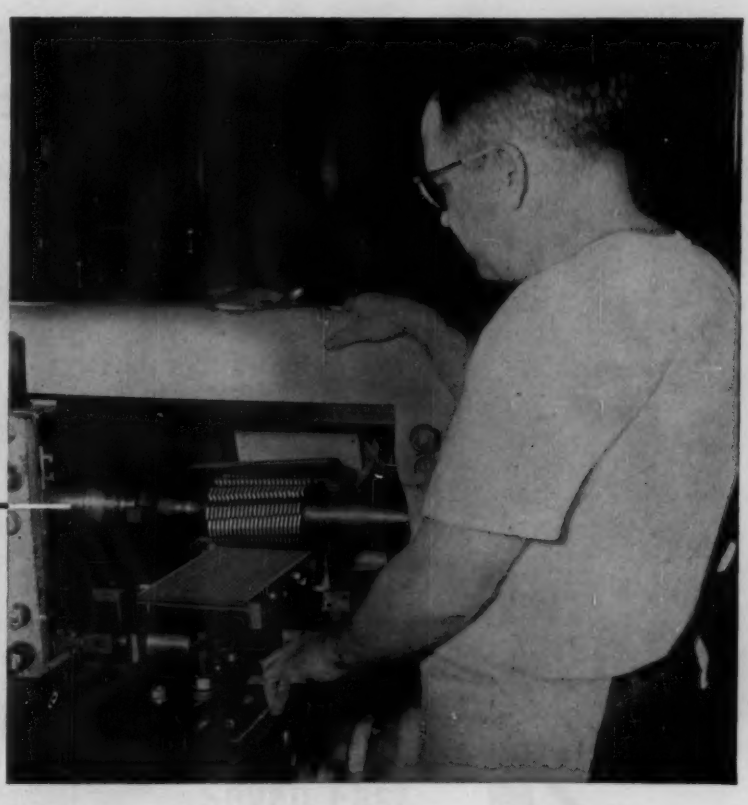
Milling gray cast iron. Cemented carbide increased production, yet provided longer tool life, better finishes on the new hard, dense types of gray cast iron. Tests on simulated engine blocks (above) showed Grade 860 took interrupted cuts with minute wear, no chipping . . . while other carbides showed extensive chipping and cratering.

Production rate doubled with Grade 370 tool

Turning 4340 steel. High-impact cutting involved on this special aircraft shaft caused rapid dulling of conventional carbides; several work stoppages per shaft occurred while tools were reground. Today, Synchro Devices, Inc., turns a complete shaft with a single Grade 370 tool . . . also gets double the production.

Daily regrinding ended by Grade 883 cutters

Gang-milling plastics. Cotton-impregnated plastic-like plugboards were so abrasive that steel cutters were down for costly, time-consuming regrinding almost daily. Switching to Carboloy Grade 883, International Business Machines Corp. milled 900,000 boards with the carbide-tipped cutters without sharpening.



COSTS WITH CARBOLOY® CARBIDES

- **Take heavier cuts, at faster speeds and feeds**
- **Lower tool cost per piece, boost machine efficiency**

Whether you're cutting steel, cast iron, aluminum—or even nonmetallics like plastics—Carboloy carbide grades will keep machines running longer at top efficiency.

Carboloy cemented carbides make your machines more productive because they take greater speeds and feeds . . . give you more output per grind. And, they'll cut unit costs through lower downtime, grinding, and maintenance costs . . . give you more production per tool. It adds up to a more efficient – and therefore, more profitable – machining operation.

Wide choice of grades

If you're cutting steel, for example, use Carboloy Extra-Performance Grades 350 and 370. These grades have proved their superiority over conventional carbides in hundreds of applications . . . doubling and tripling production in many cases.

If you're milling high-tensile cast irons, there's Carboloy Grade 860. This carbide provides greater resistance to chipping and cratering. Tests show it can increase production 20%-30%.

Or, if you're machining nonferrous materials like aluminum, brass, bronze, or titanium, you can choose from five Carboloy cemented carbides . . . and get the specific cutting characteristics you need for any job from precision finishing to heavy-duty interrupted cuts.

Broad range of products

Carboloy cemented carbides are locally stocked for immediate delivery by 139 Authorized Carboloy Distributors. They're available in the widest choice of styles and sizes in the industry.

Call your Distributor today (he's listed in the Yellow Pages). Or, send for a copy of Catalog GT-316, containing the new Grade Selection Guide for Carboloy cemented carbides. Write: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Ave., Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

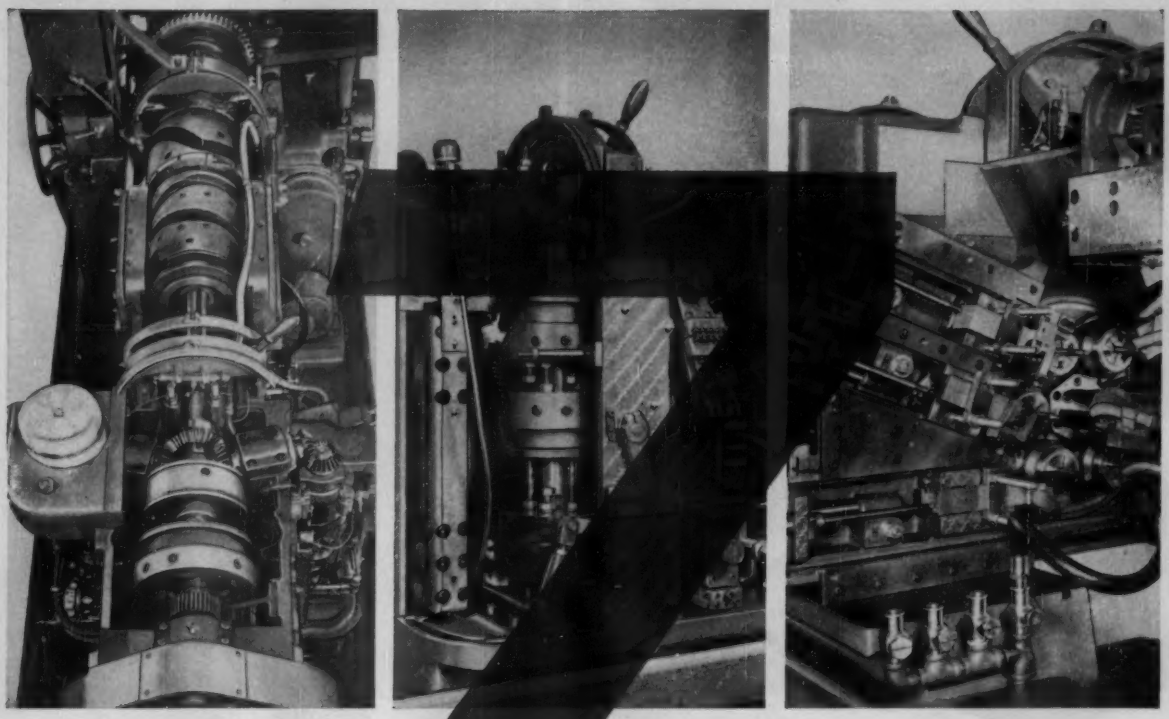
If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to **"PUT IT ON THE BLANCHARD".**

P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!

Send for free copies of "Work Done on the Blanchard"

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

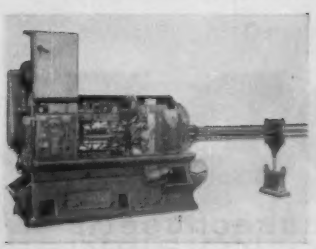


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

If you consume end mills the way a coffee drinker consumes coffee...

This brand cuts down your end mill usage, production time and costs!

The more end mills you use, the more you need Union

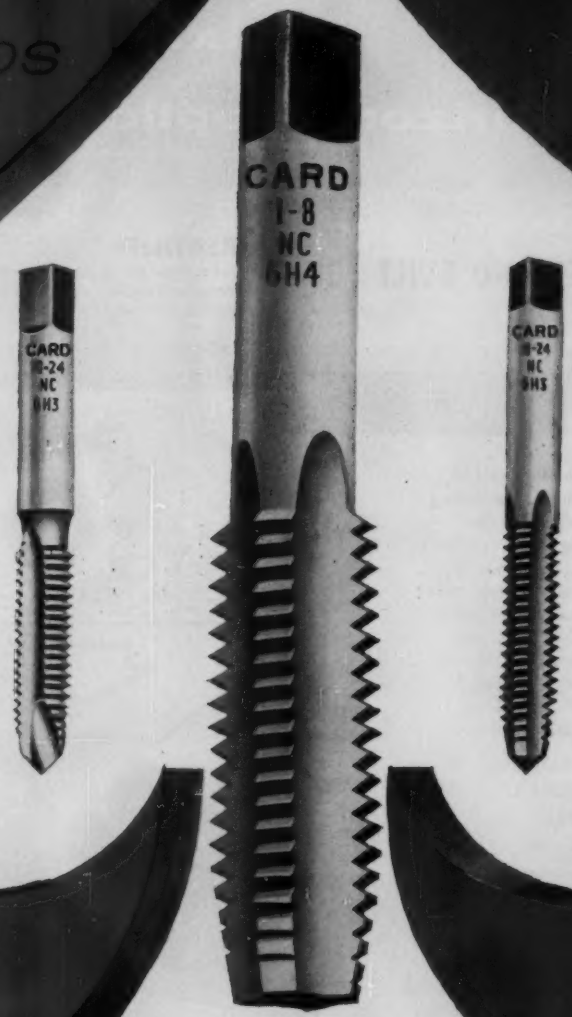
Union also manufactures drills, milling cutters, gear cutters, hobs, reamers and carbide tools. Available nationally through Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

...and in taps



CARD is

ACES with OPERATORS

Operators busy at many different tapping applications will tell you that Card taps can be depended upon for precision performance and long life — on job after job. And shopmen are sure of getting uniform top quality in gages as well as taps, every time they use these popular Card tools. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through fine distributors from Coast to Coast

dixi 60

horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

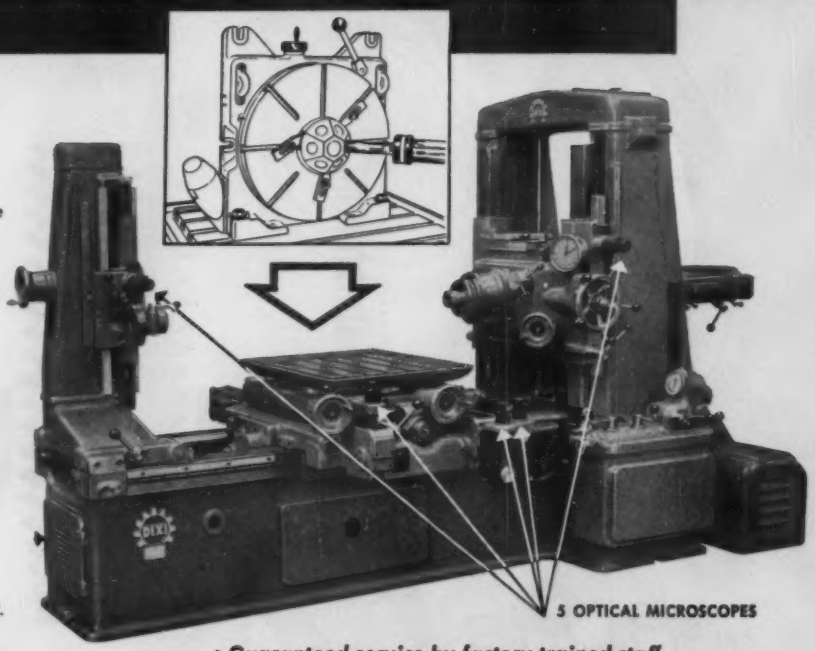
ACCURACY
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

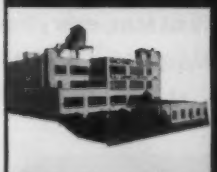
DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

MBI



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Over 20 years experience in designing & building machinery

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NOW...

a complete line of cutting oils

under one great name...

GULFCUT

GULF

GULFCUT

cutting oils increase tool life . . . lower machining costs!

- 9 different oils—a modern cutting fluid for every specific job
- Each Gulfcut oil scientifically compounded to meet exact needs

As an aid to simplification, all the famous Gulf cutting oils are now available as one complete line, under one name: GULFCUT. By ordering "Gulfcut" you can select from 9 different shop-tested cutting oils—and there's a proper type for every metal cutting need. The Gulfcut line includes mineral-lard oil, sulfurized-mineral oils, sulfurized-mineral-lard oils, sulfo-chlorinated-lard oils, and emulsifying oils. Your Gulf Sales Engineer will gladly show how Gulfcut cutting oils can mean longer tool life and reduced machining costs in your shop!

GULFCUT 11A AND 11D
Non-staining, non-corrosive mineral-lard oils, generally recommended for machining non-ferrous metals.

GULFCUT 21A, 21B AND 21C
Sulfurized-mineral oils made by a special Gulf process to provide greater sulfur activity over a wide range of machining operations. Transparent and relatively light in color.

GULFCUT 31A AND 31C
Sulfurized-mineral-lard oils that excel in performance over a wide range of machining operations on many types of steel. Have outstanding anti-weld properties and load carrying ability. Sulfur is combined in three different forms for maximum chemical activity.

GULFCUT 41A, 41B AND 41C
Sulfo-chlorinated-lard oils for high production jobs on automatic machines. Engineered with the proper combination of sulfur, chlorine and fatty oil. They also provide proper lubrication for machine tools.

GULFCUT 41TG
Sulfo-chlorinated-lard oil specifically compounded for thread grinding operations.

GULFCUT 43A
Sulfo-chlorinated oil for high production machines requiring an oil of this type for pipe cutting and threading, screw and bolt making machines, and cutting operations on steels with free and moderate machinability characteristics. Contains a corrosion inhibitor to protect ferrous metals and machine parts.

GULFCUT 43B
Specially blended sulfo-chlorinated-lard oil for high production machines requiring an oil of its viscosity and compounding. Dual purpose—suitable for machine lubrication as well as for cutting operations.

GULFCUT 45A AND 45B
High quality sulfo-chlorinated-lard oils with excellent load carrying and anti-weld characteristics to insure best results on the most difficult jobs. Have heavy concentrations of sulfur, chlorine and fatty oil. May be diluted for less difficult jobs.

GULFCUT 51A
Emulsifying oil with a wide range of uses in cutting, forming and rolling operations where a coolant with moderate lubricating properties is required. Readily mixes with warm or cold water as high as 100 to 1. Forms homogeneous and exceptionally stable emulsions.

Cutting a gear from SAE 4815 steel on Fellows Gear Shaper. Gulfcut 21-C, with relatively light color and transparency, permits close inspection of work in progress.

Machine shop at Gulf's Harmarville laboratories is a proving ground for Gulfcut cutting oils.

GULF
PETRO-ENGINEERING SERVICE

For practical technical aid, at no cost to you, call in your Gulf man. He can help you save money if you use cutting oils, lubricants, fuels, rust preventives, quenching oils, solvents, waxes or process oils. Whether you have an immediate problem—such as oil vapors, sludge or corrosion in your storage tanks, or some vital machine "running hot" —or whether you're just interested in simplifying your fuel and lubricant storage and dispensing methods . . . your Gulf Sales Engineer has a practical answer. Call him today.

GULF OIL CORPORATION
1822 Gulf Building, Pittsburgh 30, Pa.
Gentlemen:

☐ Please send me your free bulletin on Gulfcut Cutting Oils.
☐ Please have a Gulf Sales Engineer call on me.

Name_____

Company_____

Title_____

Street_____

City_____ Zone_____ State_____

GULF

GULF OIL CORPORATION
1822 Gulf Building, Pittsburgh 30, Pa.

SP-8917

Not once–BUT AGAIN AND AGAIN

production is increased . . . costs are reduced . . .

with

STUPALOX
oxide cutting tools

To get the facts, actual field tests were made comparing the performance, machining speed and economy of Stupalox oxide-base metal-cutting tools with previously-used materials. Again and again, Stupalox cutting tools outstripped all others —production was multiplied . . . machining time and costs were slashed.

And that's not all. Performance was outstandingly superior. The extreme hardness and high strength of Stupalox resulted in deeper cuts. smoother finishes and longer tool life. Good results were obtained even with materials previously classified as "unmachinable."

And remember this, *when production goes up and costs go down capital investments in machines and floor space can be reduced.*

CASE HISTORY No. 101

Turning Broach Blanks from 3⅝" diameter hot-rolled, M-2 H.S.S. Rockwell C-22-26 with Boye & Emmes Engine Lathe.

Results: With Stupalox tool inserts, the total cost of machining was cut from $12.53 to $3.61 per piece.

CASE HISTORY No. 103

Turning O. D. of Bearing Sleeves from Stress-Proof Steel, Rockwell "C" 20-25, using Monarch 18" Engine Lathe.

Results: Using Stupalox, production was boosted and machining cost reduced more than 50%.

CASE HISTORY No. 105

Rough and semi-finish bore 12" cast iron cylinder liner on a LeBlond 24-20 Lathe.

Results: Production per hour was more than doubled, cost per piece was cut from $2.26 to $.92 when Stupalox was used.

STUPAKOFF DIVISION OF **The CARBORUNDUM Co.**

WRITE DEPT. AM LATROBE, PENNSYLVANIA

More than thirty years of research and development on special purpose oxides are behind the remarkable success of Stupalox Oxide Cutting Tools—*now available in commercial quantities and in a variety of sizes and shapes.*

For further details on these and other actual case histories mail this request TODAY!

STUPAKOFF Division of
The Carborundum Company, Latrobe, Pennsylvania

Please send copies of the above case histories and other data on Stupalox oxide cutting tools.

Name_____ Title_____

Company_____

Address_____

"Engineered Production" Service

FOR BROACHING

It takes all 3

American's *"Engineered Production"* Service . . . gives the broach user the complete three-part service required to handle a production broaching job. It adds years of design and production engineering experience, unavailable at any price, to your staff at no extra cost.

THE JOB

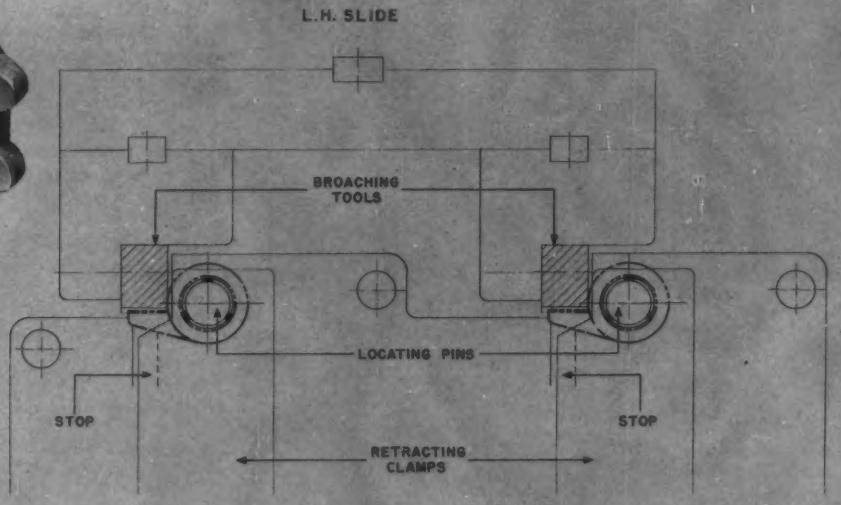
Broaching mounting face on rear wheel brake cylinders.

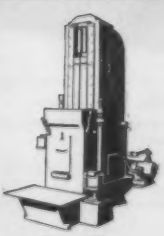
THE RESULT

720 parts per hour broached two at a time on vertical dual-ram machine removing about ⅛ in. stock.

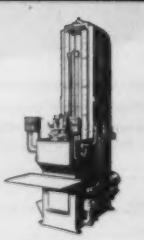
1 PROPER BROACH TOOL DESIGN

To insure top-quality results on any broaching operation the job must start with the design of the broaching tool itself. American Broach solves this all-important first step by considering: stock removal, length and width of cut, finish and tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of the work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.

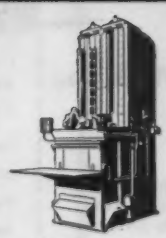




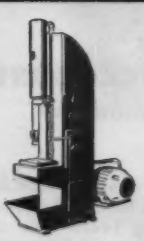
Three Way



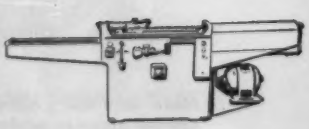
Single Ram



Duplex Ram



Presses



Horizontal

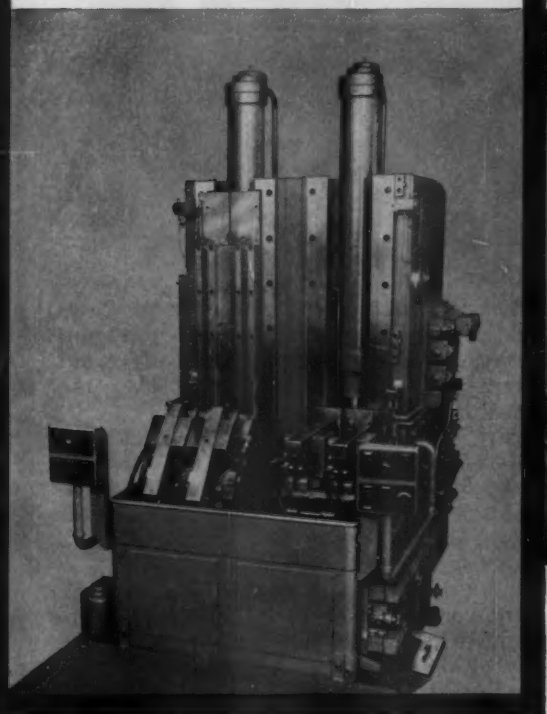
to give you peak broaching performance

2 SPECIFYING THE RIGHT MACHINE

At American, machine selection is made after the design of the broaching tool. Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space dictate the selection of the broaching machine capable of doing the best broaching job. From a manufacturer like American, who builds a complete line of standard machines and has extensive experience on specials, you can depend on getting the most practical machine for your job.

3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, workholding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.



WRITE for Bulletin A111 containing information on practical broaching methods by American.

SUNDSTRAND AMERICAN

American BROACH & MACHINE CO.

A division of SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See American First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

high scorer

... and in high speed steels, it's always REX

Crucible's REX® high speed steel always scores highest on performance—as it has for more than a half century. That's because it is consistently sound and uniform in structure... with dependable response to heat treatment.

But don't take our word for it. Check REX for yourself—by any test you choose. You'll discover that recent improvements in manufacturing techniques have made it better than ever—why REX is today, as it's always been, *the standard by which all other high speed steels are compared!*

REX is immediately available at all Crucible warehouses, or on prompt mill delivery. For a list of helpful data on REX and other *special steels*, write for a free copy of the "Crucible Publication Catalog." *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

BLISS HIGH PRODUCTION PRESSES "do-it-themselves" at Black and Decker

Just three Bliss High Production Presses produce the millions of motor laminations Black and Decker uses in its complete line of more than 150 portable power tools!

Running in the upper speed range, sometimes at well above 250 strokes per minute, through two shifts a day—and occasionally three. And they've been doing it for a long time now with no problems.

Of course, H-P presses are built for speed. Extra heavy cast Meehanite frame • *Square* gibbing • Automatic lubrication • Variable speed drive • Special air friction clutch • Counterbalanced crankshaft. Every feature has been especially designed to maintain precision at top speeds. That adds up to top production rates, longer die life.

Another plus, users tell us, is the wide open die area that makes quick set-up and changeover possible. In fact, the fast set-up makes *short-run* work practical with Bliss H-P Presses. And the room *under* the press is a handy place to run chutes or store tote boxes.

If production of short-stroke stamped parts is your problem, long run or short, you'll want to learn more about Bliss H-P presses. Our recently revised 32-page catalog No. 27-C describes the entire line and gives examples of the wide range of work you can accomplish with these presses. Why not write for a copy today.

BLISS
SINCE 1857

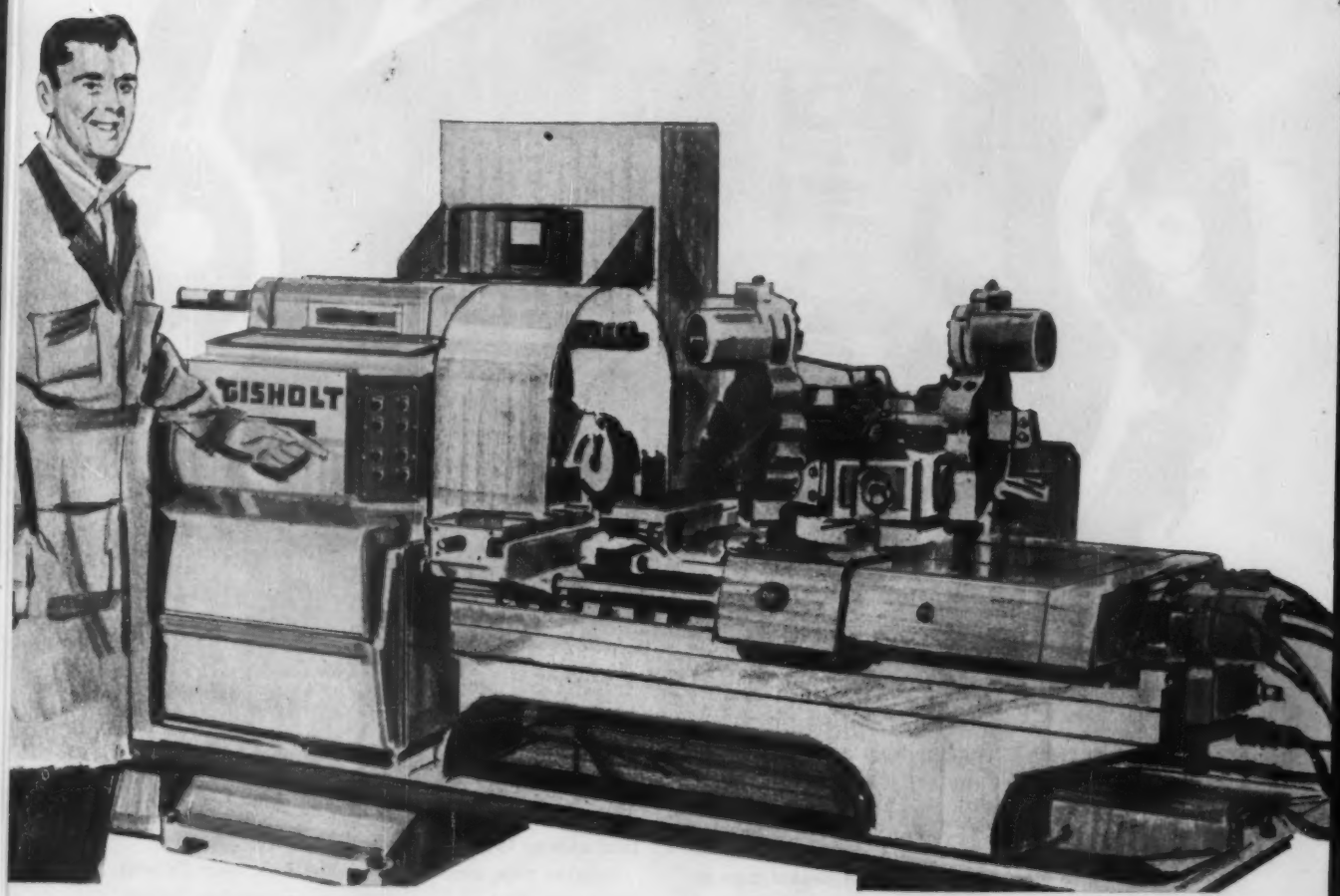
is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, California; *Branch Offices* in Boston, Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

E. W. BLISS COMPANY, CANTON, OHIO • Presses, Rolling Mills, Rolls, Special Machinery

NEW Gisholt Fastermatic

CUTS YOUR SETUP TIME



GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

MASTERLINE
GISHOLT SINCE 1887

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

control panel

50% OR MORE

BY SIMPLY FLIPPING TOGGLE SWITCHES, your operators can cut automatic turret lathe setup time 50% or more with this electric setup control panel.

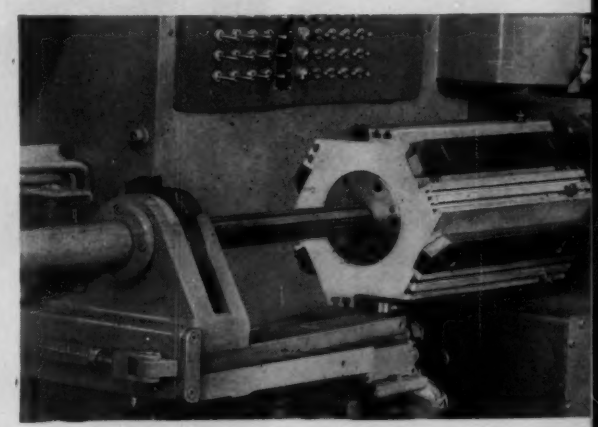
Thoroughly proved in production lines, this control panel is one of the many advanced features available on the new Gisholt MASTERLINE Fastermatic Automatic Turret Lathe.

Here's how the panel works: within finger-tip reach, your operator has a horizontal row of toggle switches for each face of the hexagon turret. By simply flipping the switches right or left, he pre-selects desired machine functions. Re-runs? Here the Fastermatic makes even more drastic cuts in setup time. A master reference card, made from the previous run, is used, and the machine is ready to go with absolute minimum preparation. Feed changes are fast and easy. Tool overhang is quickly minimized by re-positioning the saddle. Anywhere within the machine cycle, the operator can make a trial cut, withdraw the tools, mike the part, re-set the tools and resume forward feed.

What does this versatility mean to your own operations? It means more time spent cutting chips and more profit per piece. It means that less skill is required of the operator and he is free to handle additional units or do other work during machining cycles. It means you can utilize smart tooling and eliminate human errors...get record production on long runs ...*and also get the advantages of automatic cycle operation on relatively short runs.*

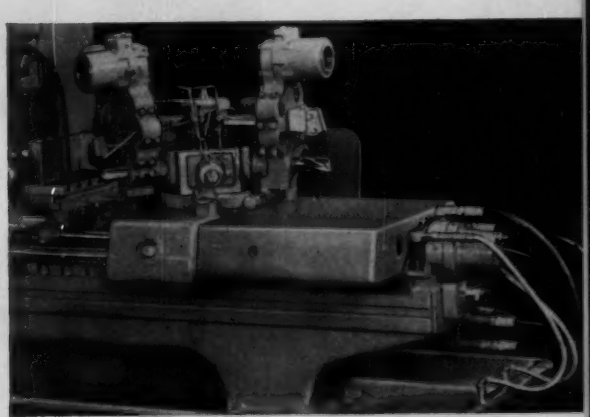
Ask your Gisholt Representative to tell you about the Fastermatic's new electric control panel...its increased capacity...its higher speeds and feeds and heavier construction. You'll also want to know about using the Gisholt JETracer on the Fastermatic. Call him today—or write Gisholt for literature...ask for Bulletin No. 1179.

NEW GISHOLT FASTERMATIC CONTROL PANEL—simple toggle switches govern basic machine functions, cutting initial setup time in half. Master reference card is used to cut setup time still more on re-runs.



HEXAGON FEED CONTROL DRUM—positioning of adjustable flat bars on each face determines rate of feed. Thumbscrew actuator pins in slots on each face determine point of change from traverse to feed and length of feed.

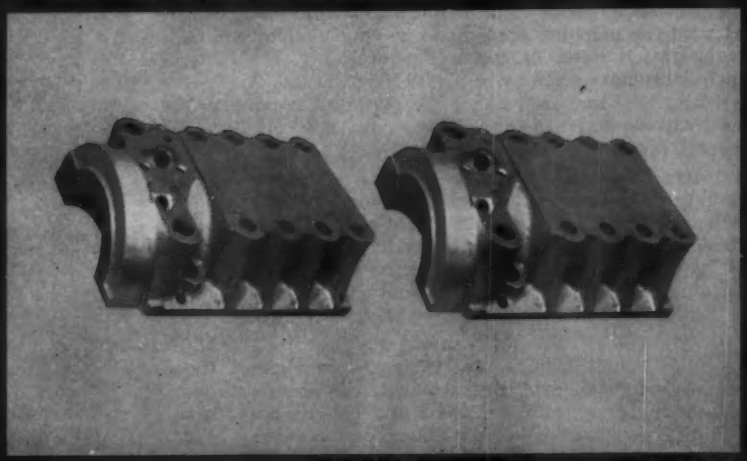
GISHOLT JETracer—mounts on any one of Fastermatic's turret stations. Provides exceptional accuracy for turning, boring or facing—either straight, taper or contour. Hydraulically operated; stylus follows contour of template controlling movement of single-point tool on sliding member.



FASTERMATIC TURRET SADDLE is hydraulically powered for indexing and longitudinal movement. Automatic cycle easily set up with turret double- or triple-tooled. CROSS SLIDES—front and rear—operated by forward movement of turret saddle, can work independently, or together, with any turret face.

THREE NEW DEVELOPMENTS
Increase Production

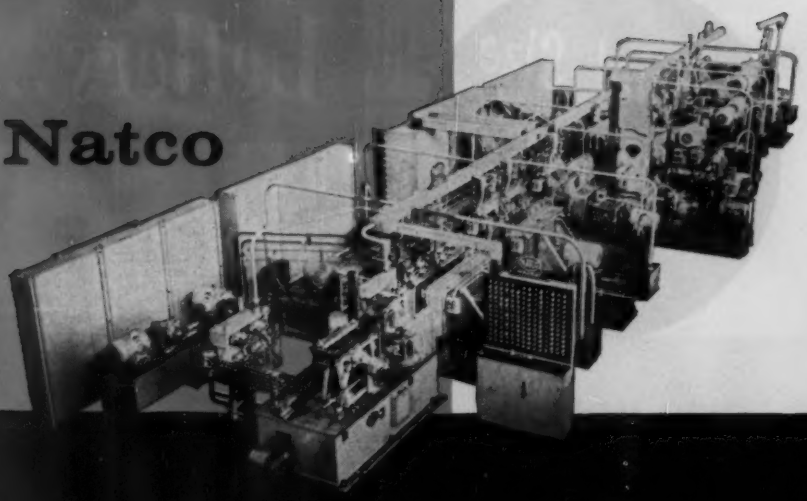
2-at-a-time processing



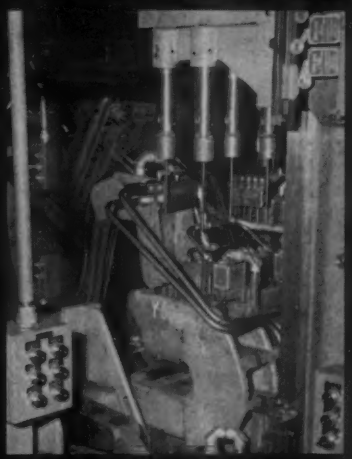
300 HP Natco greatly increases production by processing two complete sets of bearing caps at once.

Bearing caps—240 *sets* per hour—six times the production rate of the machine replaced! This new Natco processes two complete sets at once. It loads surface-broached castings automatically, performs 80 machining operations, places matched sets of finished bearing caps on the assembly conveyor. In addition to broaching and sawing, this 300 HP, 27-station Natco, drills, reams taps, turns, mills, probes and faces.

help this Natco 600%

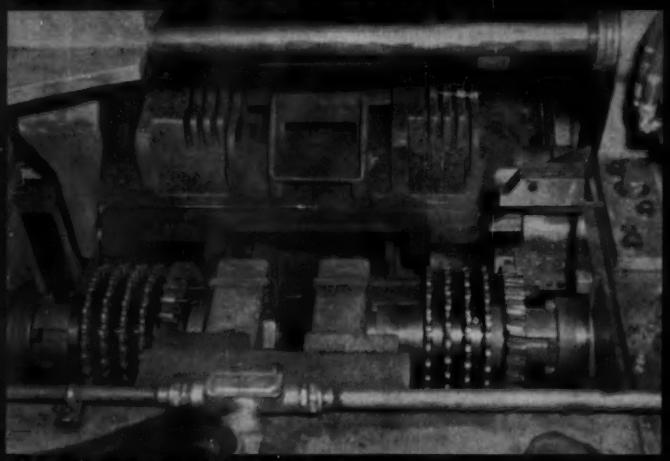


Unique Broaching Station



Fully automatic broaching station eliminates need for withdrawing broaching tools after cut. Broaching tools are pulled completely through hole, removing .030" stock.

New Rigid Saw Station



80 HP sawing station cuts two castings into complete sets of 5 caps each. All surfaces parallel within .0015". Fixture feeds castings into stationary mounted saws, providing rigidity for accurate 14 ipm cutting.

Whatever your high production problem, our engineers will work closely with your people to develop exactly the method and the machine to do your job best. Besides special way-type, index and transfer machines, Natco also builds multiple drilling, boring, facing and tapping machines. Call your nearest Natco office in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles. Distributors in other cities.

Partners in Production

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC. *Richmond, Ind.*

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan

Special Size Reamers
ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .1230 thru .4995" Sets, tool

OVER & UNDER SIZE CHUCKING REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .124 thru .501" Sets, tool

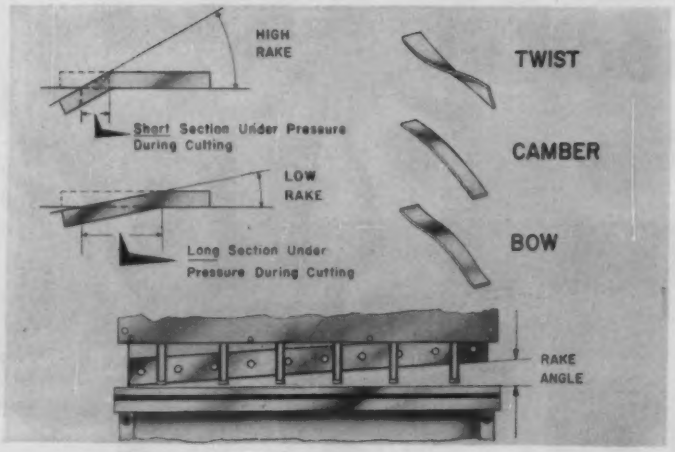
These reamers are two more reasons why L&I is the source for a complete reamer line.
See your L&I Distributor.

L&I

"the reamer specialists"
LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Letters...

To American Machinist
330 W 42nd St, N Y 36, N Y



How a Shear Cuts

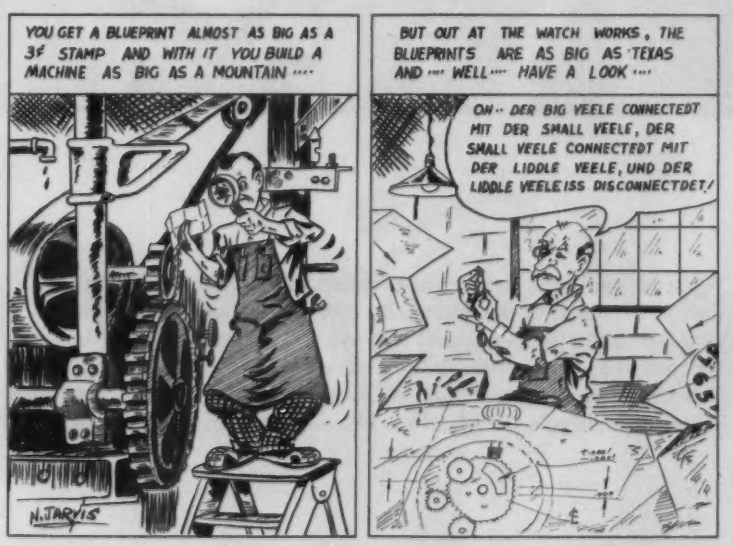
There is a common misconception in many shops concerning the use of power shears. There is a wide-spread belief that a shear can be used to cut stock heavier than the rated thickness, simply because the sheet is less than the full width of the shear. For Example, an attempt may be made to cut a 3-ft width of ⅜-in. stock on a shear rated ¼-in. by 10 ft in the belief that that load on the shear will be less, just because the area of the sheared surface is less.

The error of this figuring is evident when you consider the actual process of shearing. Because of the angle of the moving blade, the cut progresses along the length of the shear, and only a short length of the sheet is being cut at any one time. Consequently, the width of the plate or sheet to be sheared has no relationship to the pressure required to force the blade through the stock.

When the thickness of the sheet

SHOPMATES

N. Jarvis


YOU GET A BLUEPRINT ALMOST AS BIG AS A 3¢ STAMP AND WITH IT YOU BUILD A MACHINE AS BIG AS A MOUNTAIN ....
BUT OUT AT THE WATCH WORKS, THE BLUEPRINTS ARE AS BIG AS TEXAS AND .... WELL .... HAVE A LOOK ....
OH .. DER BIG VEELE CONNECTEDT MIT DER SMALL VEELE, DER SMALL VEELE CONNECTEDT MIT DER LIDDLE VEELE, UND DER LIDDLE VEELE ISS DISCONNECTDET!
N. JARVIS

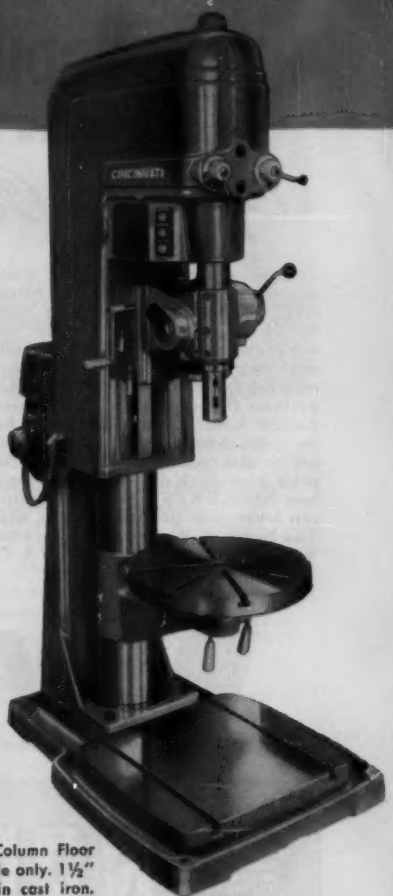
New 21" Box Column Floor Drill. Single or multiple spindles. 1½" drilling capacity in cast iron.

that Quality Look tells You they're

CINCINNATI

Sliding Head Drills

. . . and even better than their appearance, is their performance!

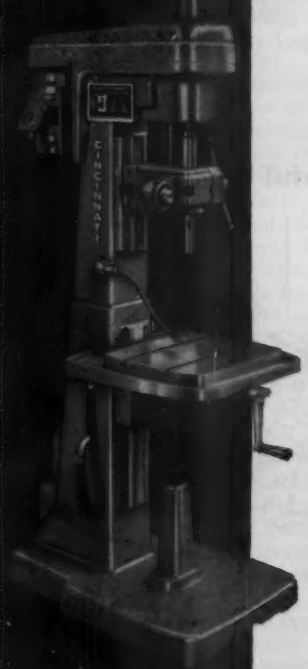


These new Cincinnati-engineered Sliding Head Drills give you the capacity, ease of operation, high accuracy and rigidity of drilling machines that *cost far more!*

Features: New geared power feeds . . . new depth dial with positive stop and automatic feed disengage . . . new massive spindle, extra rigid . . . new motor drive . . . new electrical controls . . . new unit construction of column and frame . . . new tables and bases . . . new standards of accuracy.

You'll speed up and improve your drilling machine operations by replacing all of your outmoded drills with these new, economically-priced Cincinnatis. See them and test them at your local CL&T dealer. Write direct for catalog data. Cincinnati Lathe and Tool Co., 3207 Disney St., Cincinnati 9, Ohio.

New 21" Round Column Floor Drill. Single spindle only. 1½" drilling capacity in cast iron.



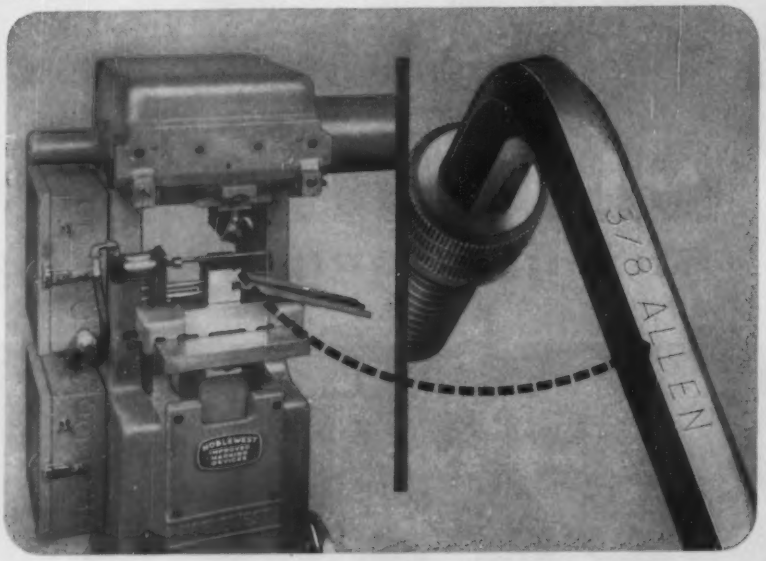
New 16" Box Column Floor and Bench Drills. Single and multiple spindles. 1" drilling capacity in cast iron.

center on

cincinnati lathes and drills

Builders of Engine, Toolroom and Fixed Gap Bed Lathes and a complete line of Drilling Machines

ANOTHER LEADER OF INDUSTRY MARKS WITH NOBLEWEST



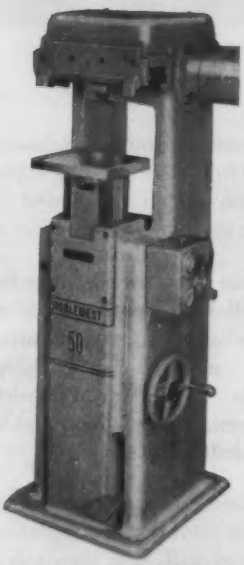
Model 50P1—395 Roll Marks manufacturer's name and size identification permanently into all sizes of Allen Head hex wrenches.

HIGH PRODUCTION MARKING

WITH NEW

Cyclomatic Control

This general purpose marking machine combines the original NOBLEWEST Roll Marking process with CYCLOMATIC CONTROL . . . an exclusive NOBLEWEST electro-pneumatic circuit for completely automatic cycling. When set for automatic operation the machine cycles continuously with no further attention required from the operator. A dual control system also provides for semi-automatic operation or for short production runs. This model can also be equipped with an air ejection system (see above) plus an automatic hopper or dial feed. The basic Model 50P1 features a low price, plus quick delivery! For complete information on how NOBLEWEST Marking Machines, tools and dies can lower your production costs, write for new catalog. The Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.



At left are Noblewest Precision Roll Marking Dies used for marking Allen wrenches. Inscription is duplicated three times on each die, thus tripling the die life.

MARK IT BEST WITH

NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

is doubled, the length of the blade in the cut at any one time is doubled, and the shearing pressure is doubled. Cutting stock heavier than the rated thickness will overload the shear even on a narrow sheet.

Clifford Molloy
New York, NY

We agree with Reader Molloy, but we wrote to a shear manufacturer to see if there were any loopholes—Ed.

Mr Molloy is absolutely correct in his discussion of the danger of using a shear for more than its rated capacity. As indicated on the sketch, the angle formed by the upper blade with the lower blade is referred to as the rake angle and is usually indicated in fractions of an inch per foot.

On a machine which has high rake, the metal that is being sheared suffers severe deformation which results in one of three different conditions: twist, camber, or bow. In instances where the cut is simply a trimming operation with the piece cut off ending up as scrap, a machine of high rake, low horsepower, and light construction can be used to good advantage. However, it is not practical to use a machine of this type where the material cut off is to have some further processing and use. Therefore, we recommend and use the lowest rake angle that is consistent with practical design.

The points in Mr Molloy's letter are good and should be of great

Helpful Henery

"I'll catch that scrap, Mr. Hoskins!"

interest to owners and operators of squaring shears. However, we know from experience that, regardless of how much you try to impress upon operators the importance of not using a specific machine for thicker material than it was designed for, many operators insist on trying to push a shear beyond its capacity.

Arthur V Baumann
The Lodge & Shipley Company
Cincinnati, Ohio

Objection Sustained

You fellows seem to think that a production man has all the time in the world for reading AMERICAN MACHINIST. Why do you tell us on the cover that you have an interesting article and then hide the article somewhere in the middle of the magazine—under a different title?

On the cover not long ago (*AM*—Nov 19 '56), you said this: "Two ways to drill deep holes." That's one of my tougher problems, so I wanted to see immediately what you had to say about it.

When I scanned the contents page, I didn't see anything about the two ways to drill deep holes, so I leafed through the magazine, getting more irritated by the minute. After about ten minutes of that, I said, "To hell with it," and pitched the magazine on the stack labeled, "To be read—maybe."

Later, when I had more time, I did manage to find the article, and I got some interesting information out of it. However, it was a nuisance to have to hunt for it instead of being able to turn right to it. Why don't you put the page number on the cover when you spotlight an article like this?

Walter Hannan
Long Island City, N Y

The problem posed by Reader Hannan is not a simple one. Because of the production time required, color covers go to press long before the issue is firmly planned. We have been working on methods to shorten the time-lag so far as the listed titles are concerned, and recent issues are better in this respect. With the next issue, we expect to start showing page numbers on the cover, and we thank Reader Hannan for his comments—Ed.

REED RTD

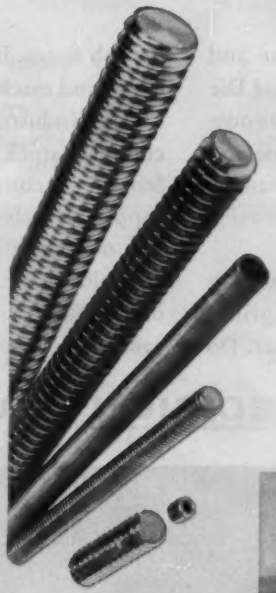
Thru-feed Thread Rolling

for Continuous
Precision Threading
of Long or Short Bars and Tubing
and Short Headless Parts

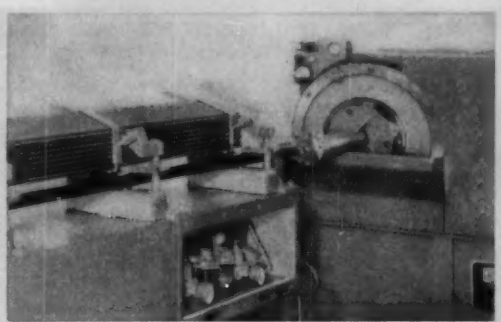
DIAMETER CAPACITIES—¼" to 3"

REED MACHINES

Provide Uniform Pitch Diameter
and Accurate Thread Form
Over the Entire Length of the Threads



Hollow and Solid Parts
Threaded by
Thru-feed Rolling



Thru-feed rolling may be used for threading both solid and hollow pieces of varying lengths and materials. Various forms may be rolled, including worms and Acme threads. Headless pieces, with threads running the entire length, may be threaded in bar lengths and then cut up into desired finished lengths.

Machines may be arranged for both manual and completely automatic loading and unloading of the parts . . . the rolling cycle with either method of loading is fully automatic. The work blank is rolled between cylindrical dies and is finally discharged at the rear of the machine. Short, headless pieces may be loaded into a chute and automatically fed, rolled and discharged. Controls are available that permit rolling the entire length, ends or middle section of a part.

Reed thread rolling machines are made in 2 die horizontal and 3 die horizontal and vertical types for thru-feed and in-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Operating handbooks are available so the tool engineer and operator can set up his own applications.

Write for Thread and Form Rolling Bulletin 119

REED ROLLED THREAD DIE CO.

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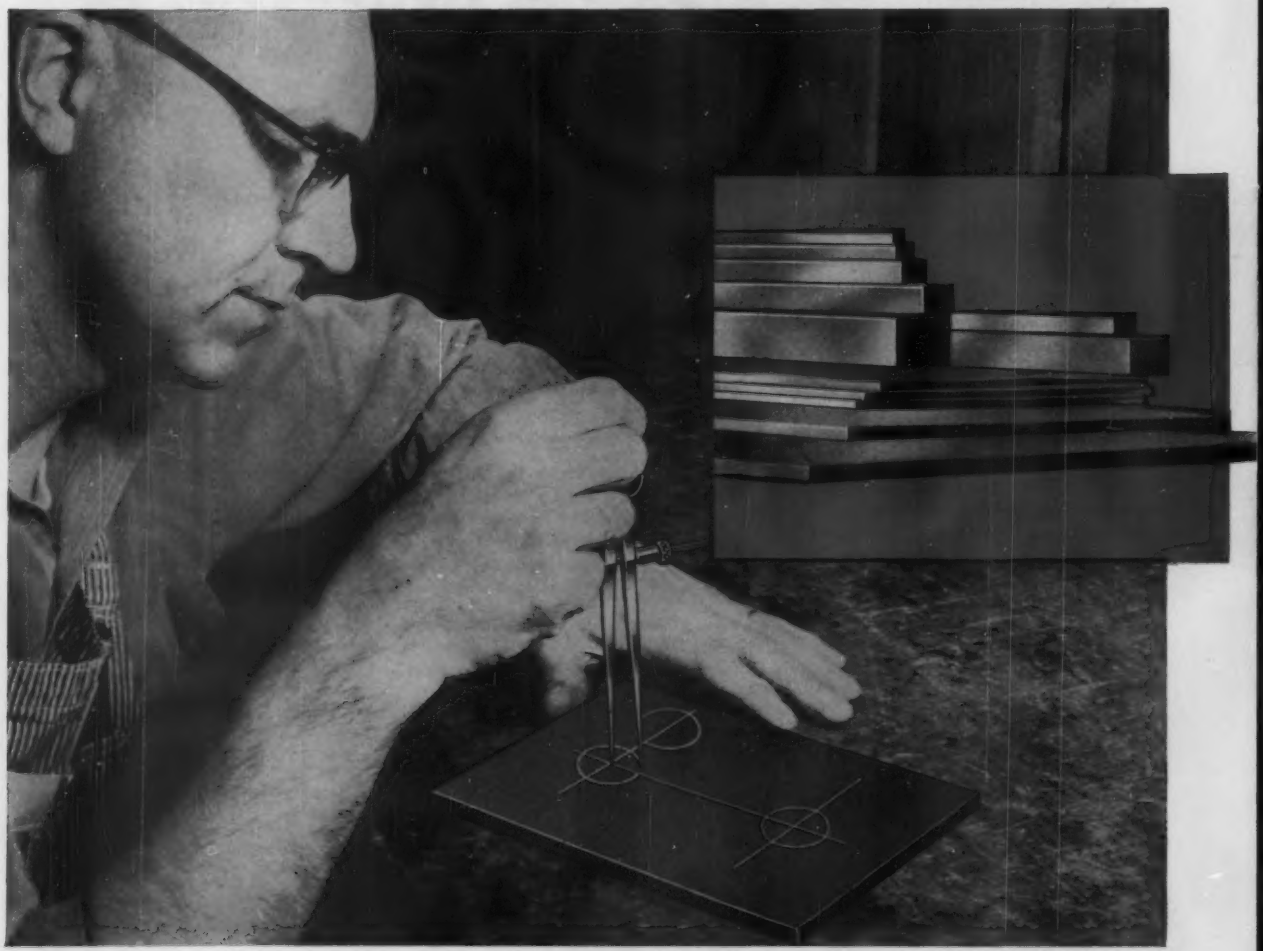

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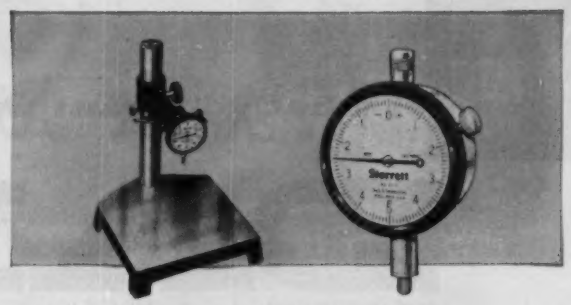

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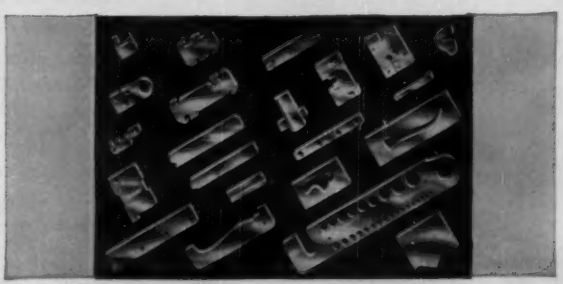

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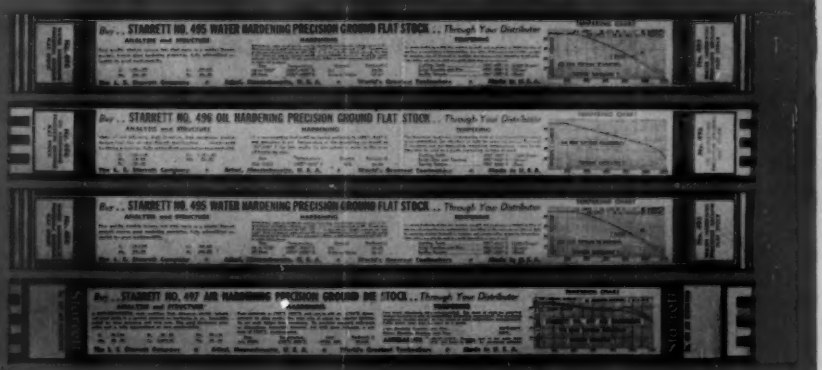
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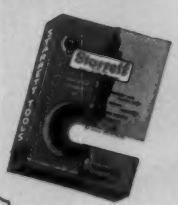
Tool room wall chart lists all types and sizes with hardening instructions.

BIG NEW CATALOG NO. 27.
Describes and illustrates the complete Starrett line.



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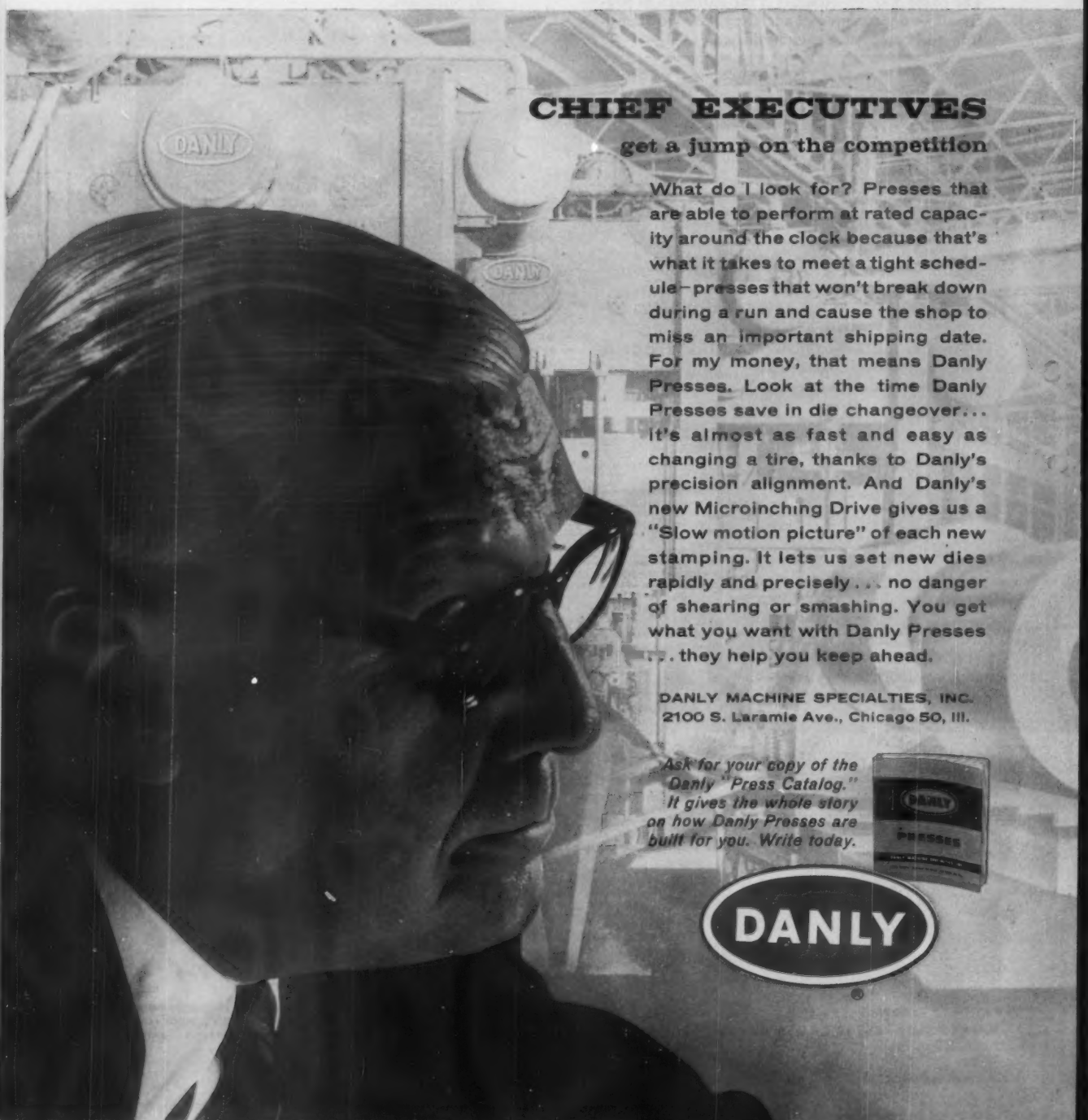
PRESSES



CHIEF EXECUTIVES

get a jump on the competition

What do I look for? Presses that are able to perform at rated capacity around the clock because that's what it takes to meet a tight schedule—presses that won't break down during a run and cause the shop to miss an important shipping date. For my money, that means Danly Presses. Look at the time Danly Presses save in die changeover... it's almost as fast and easy as changing a tire, thanks to Danly's precision alignment. And Danly's new Microinching Drive gives us a "Slow motion picture" of each new stamping. It lets us set new dies rapidly and precisely . . . no danger of shearing or smashing. You get what you want with Danly Presses . . . they help you keep ahead.

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Ask for your copy of the Danly "Press Catalog." It gives the whole story on how Danly Presses are built for you. Write today.

DANLY®

Spot news...

- **Ford and Chevrolet will both have gas-turbine trucks in production** within 18 months. Chevvy will have an improved 200-hp version of the Firebird II engine.
- **Routing (instead of milling) 80-ton tensile strength steel** is being tried successfully in England. Pocketing and rough profiling are done with a 1.5-in.-dia cutter tipped with titanium carbide, running at 6000 rpm and cooled by CO_2. Operation is done in 15 min, compared to 1 hour for milling.
- **Harbinger of the 30-hr workweek in the auto industry?** Office staff of Ford local 600, Detroit, has dropped 5 hours off its 35-hour week with no decrease in pay. Union officials say this has been done so the union can prove it practices what it preaches when the next round of auto bargaining comes up.
- **Ceramic honeycomb, complete with ceramic skins and able to withstand 2000 F** in repeated heats, is in the lab stage at Continental Can. Strength of the ceramic material is 350,000 to 400,000 psi, that of the completed "sandwich" is 25,000 to 30,000 psi in compression. Tolerances can be held to ±0.005 in.
- **Ford truck-building expansion slated for Sao Paulo, Brazil:** a $3-million engine plant with $4.5 million worth of machines and equipment; a $4.5-million foundry; $1.5 million in new presses for its existing stamping plant. By 1960, Ford expects to manufacture 30,000 90%-made-in-Brazil trucks a year.
- **Controlled stretching of duralumin is being done in England for the first time** by a combined forging-rolling process that insures machining without subsequent distortion. Plates were previously imported from the U S.
- **A $125 bonus is being paid to each employee who recruits an engineer** by Fairchild Camera & Instrument Corp, Mineola, L I, N Y. $30 is paid five days after the engineer starts to work, the balance if he stays three months or more.
- **Auto transmissions may soon move back to the rear axle.** Chrysler may come out with it in '58, and all other automakers are working on the idea. It means radical retooling to accommodate air suspension, changes in differentials, independent wheel suspension, and new integral body-chassis combinations.
- **Non-military uses for titanium must be created to build-up facilities** and production in the event of war, a group of 50 California aircraft firm representatives were told recently by Mallory-Sharon's Frank H Vandenburgh.
- **Hungarian government will build a body-assembly plant for Renault of France,** at Renault's request, "somewhere in Hungary" soon.
- **New process for hard-surfacing stainless steel parts,** "Supercase," allows depths to be controlled to very close limits (normal case depth with Supercase: 0.003 to 0.007 in.) and case may be removed, the parts reworked and re-nitrided. If further machining is needed after nitriding, the part can be masked off and will remain soft after processing. Applies to martensitic and ferritic steels, as well as austenitic.
- **New British tack-welding method and process for lap-welded sheets** uses a consumable electrode, which as the arc starts is automatically fed toward the work at rates up to 200 ipm for a 1/16-in. electrode, while the arc is shielded by argon. Weld is timed to fill crater with metal from the electrode.

Spot index to major News stories...

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STYLE 1212-B. For identical or different operations at each end. When loading time of parts approximates the time of machining, a double-end machine practically doubles production.

STYLE 2112-B. Single-end model for work pieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of work cycle.

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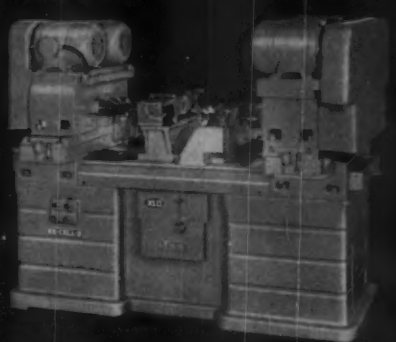

STYLE 17-A. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be tooled for a wide range of production jobs.

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Whichever model fits your production requirements, you'll find this large variety of precision operations will lower your costs—increase your profits.

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Contact your local Ex-Cell-O representative who will provide all the facts about these machines, or write to Ex-Cell-O for a precision boring catalog.

57-1

EX-CELL-O FOR PRECISION

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Washington ... NEWS REPORT

A-power equipment market . . .

A plump new market for U S atomic power equipment is in the making. Plans are now under way for installation of 15-million kw of nuclear power capacity in Western Europe by 1967 under the auspices of Euratom—the proposed supranational European atomic power agency. Its members—France, Germany, Italy and the Benelux countries—will get U S atomic know-how, fuel, and equipment, either through direct export sales or on a licensing basis.

Up to now, U S atomic reactor makers have been saddled with heavy research and development expenses, while the outlook for competitive atomic power in the U S is cloudy—experts don't see it for at least another decade. But now, with Euratom ready to install 3-million kw of A-power capacity per year for five years (equals 250 plants like the one at Shippingport, Pa), and with at least half the reactors to be purchased here, U S atom equipment makers can look forward to $ billion in new business.

Knotty Metalworking problems . . .

Meanwhile, in the United States, the first nuclear power plant exclusively for output of electric power has gone into operation at Argonne National Laboratory, Lemont, Ill. And while the Argonne installation ushered in a "new era in power generation," according to the AEC, it brought new headaches for metalworking.

Nuclear power plants call for parts made from little-known hard-to-fabricate metals—and vendors and erectors will have to learn some new machining techniques to cope with them.

For instance: the core consists of 114 fuel assemblies each 77 ft long, 3 in. square, and containing six fuel plates fabricated from uranium-zirconium-nobium alloy sheets. Core components are made from Zircaloy-2, which has about the same machining, forming and welding characteristics as titanium—but cannot be touched with bare hands, only clean gloves.

Reactor control rods are of two types, offer tough metalworking problems, too. One type is made from hafnium, Zircaloy-2 and stainless; the other from stainless steel containing 2% boron. The rods are made from rolled sheet, formed into angles and spot-welded together to form cross-shaped sections. Not only are the materials difficult to work with, they must be made to precision tolerances so that they will move freely in the core assembly.

Search for labor peace . . .

Rival industrial and craft union officers are making another stab at writing a peace formula over construction jobs in industrial plants. The age-old battle has simmered down long enough to let AFL-CIO President George Meany and other labor leaders try to devise a working system to end jurisdictional battles.

This is a high-level truce, however. The job-site wars won't stop while the captains debate settlement terms.

These conferences are another mark by Auto Workers' chief Walter Reuther who's getting what he wants in the AFL-CIO. It was Reuther, working behind the scenes at the Federation's recent Executive Council meeting. He won over the recalcitrant building trades unions to the coming peace conference; he out-maneuvered his chief opposition in the AFL-CIO, Teamster vice-president James R Hoffa, who plugged for full resistance to any agreements. When the Executive Council session was over, the AFL-CIO began to look much like the old CIO federation. It had the Reuther stamp all over it.

Specific jurisdictional disputes are already starting to get settled. The recent investigations led by Meany into the Sheet Metal Workers vs Steelworkers conflict at the Akron plant of Burt Mfg Co is a case in point. This is a long-simmering one, with the Sheet Metal Metal Workers boycotting Burt's ventilating equipment, which is manufactured by the steel union. The boycott by the craft union, protesting invasion of production workers into its bailiwick, is also against other USW- and UAW-organized plants.

The Sheet Metal Workers had won a recent battle with the Electrical Workers' union on a jurisdiction issue. The AFL-CIO Executive Council charged the electrical workers with raiding a plant where the craft union is bargaining agent—the Belock Instrument Corp at College Point, L I, and ordered them to cease trying to take over representation rights.

Industrial heating equipment . . .

Commerce Department's BDSA plans to survey the industrial heating equipment industry, to get a picture of mobilization capacity and requirements. A questionnaire will go to some 200 firms to find out current production and capacity, today's material consumption compared to that during Korea, products, order backlogs, plant locations, and the like. The survey must first get the Budget Bureau's okay, however.

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To the skier, precision performance means balance, muscular coordination, and lots of experience.
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Detroit ... NEWS REPORT

Ford's new Edsel . . .

"To set at rest the rumors that seem to be rampant about the new car," Edsel officials held a press conference in Detroit this month.

The new line of Edsels will be four in number. Pricewise, they'll compete directly across the board with the four Buick lines. In order of price tag from bottom to top the new Edsels will be the "Ranger," "Pacer," "Corsair," and the "Citation."

The Edsels will be introduced as 1958 models, probably in the fall. Said Edsel officials, "We're aware of the date of the autumnal equinox when we mean fall introduction"—and that date is September 22.

Edsel people say that more than 2200 applications for dealerships have already been received —more than 1000 of them from dealers now selling cars not manufactured by Ford. Detroit is wondering just how many of these "foreign" requests come from dealers who want to act as intelligence agents for their home factories.

The production lineup . . .

Over at Chrysler Corp, Plymouth is beginning to retool to keep up with orders. Hardtops and suburbans are running six weeks behind delivery time. Production has been upped, with Saturday time scheduled for late February and March.

Dodge is on two shifts in most of the plant, with both sales and production schedules up.

DeSoto's January production set an all-time record for the month.

Chrysler is on one shift, nine hours, six days a week—producing heavily.

Imperial output is record-shattering, and it looks like it's closing the gap on Lincoln.

At Ford, the Ford nameplate is having the most productive January in its history. Dealer stocks are reportedly almost 20% below year-ago levels. Two car assembly plants are working six days.

Mercury's January sales were up 14% over a year ago, and Lincoln is on a six-day week with no end of heavy orders and output in sight.

At General Motors, Chevrolet production is down slightly, but introduction of the new "Positraction" axle is expected to boost sales a little. While Chevvy has been hit hard by Ford this year, it's still ahead on production slightly.

Pontiac sales are picking up, with that nameplate showing a 7.9% increase over a year ago. Oldsmobile is on a 5-day production week, with sales beginning to increase slowly. Cadillac is still doing a nice steady 3400 cars a week.

But the fly in GM's ointment is Buick—January production was down 18.4% from 1955 levels.

At American Motors, Nash-Hudson sales over the last four months have been off 35% from year-ago levels, but the Rambler chalked up the best January since its birth in 1950—a healthy 41% over January 1956.

Studebaker-Packard has some pretty gloomy news to report in the Studebaker department—January 1957 production ran 77% under that for January 1956. But Packard hopes are better. Just beginning production for 1957, Packard is turning out 600 cars a week, with a big increase in number of dealers. Sales expectations, the S-P people say, are "good."

Predictions coming true . . .

As we have predicted, the automakers are swinging to air suspension on the '58 models, and the Cadillac Brougham is coming out with it this month.

Other deluxe models, such as the Thunderbird and the Lincoln will reportedly have it on '58s.

Chevrolet, too, may offer it as an option next year, and the Chevvy people think that at least 25% of all buyers will pick up the option right away, and more as the model year goes on.

As one engineer puts it, "The time is coming, I'd say within three or four years, when you'll have to order metal springs specially—all suspension will be either air or air/oil."

You can look for all makes in the Big Three to take up air suspension quickly, but American Motors' plans to introduce it as a running change on '57 Hudson and Nash models have run into some production snags.

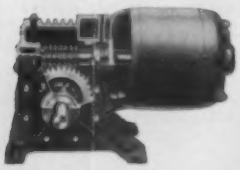
Chrysler is ready with fuel injection if sales pressure warrants and can put its "ramjet" mechanical system into full production on short notice. Ford is also working on a version, has five systems under study, but unless it can improve what it has to date, fuel injection won't be introduced this year—and maybe not in 1958.

Ford does have a supercharger ready, however, for introduction in the very near future. It will be introduced quietly after all the bugs have been ironed out. Ford doesn't want the unfavorable comment that greeted a competitor's engine innovation recently.

How to dial a pair of pants

MASTER

At the touch of a switch, unit rotates and indexes correct order to delivery position. It's fast, accurate and multiplies floor space efficiency. Power is a ⅓ H.P., 115/230 volt, 60 cycle, 1 phase Master Right Angle Gearmotor.



ANOTHER DRIVE REQUIREMENT MEETS ITS MASTER

You look at a motor application in an ad, and 99 times out of a hundred first thing you say is, "But my problem's different." Here, it's 100 to one you'll be right.

Point is the manufacturers of this fast, efficient and extremely ingenious dry cleaning storing mechanism told Master what they needed. Light, geared-down, steady power, full start, positive stop. And whenever the attendant in a progressive shop so equipped dials your pants, a Master Gearmotor delivers the goods.

And Master can deliver the goods for *you!* Master components can be integrated in any combination to give you the right horsepower, right shaft speed, right mounting features, in a single, efficient compact unit. See Master for your drives!

Motor Ratings	⅛ to 400 H.P. All phases, voltages, frequencies.
Motor Types	Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.
Construction	Open, enclosed, splash-proof, fan-cooled, explosion-proof, special purpose.
Speeds	Single-speed, multi-speed, and variable speed.
Installation	Horizontal and vertical, with or without flanges and other features.
Power Drive Features	Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.

MASTER ELECTRIC MOTORS

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Machine tools ...

NEWS REPORT

One rule for three services . . .

Next move in the effort to get the armed services going in their program for replacement of machine tools is to secure an agreement among the Navy, Air Force and Army on a uniform replacement formula.

Bureau of Budget insists that it will not authorize spending for replacement until one rule is applied to all three services.

Each service now has its own formula. All three formulas are pretty close to each other down to the point at which you start to figure savings.

Defense Department is hopeful of persuading the services to reconcile their differences. But short of that, the Department will have to make a choice and tell the services that they must abide by it. Navy, incidentally, has studied replacement the longest, Bureau of Ships having made a survey of Navy yard replacement needs the past few years under A J Weisbecker.

There are plenty of obstacles, apart from agreement on a replacement formula, in the way of any sizable replacement expenditure by the services in fiscal 1958.

For one, funds are to be spent only to replace machines currently in use, not those in departmental reserves or in inactive plants. The services have the job of coming up with projects that can fully justify themselves. And that takes time. Spending $150 million, the maximum allowable sum, is a big undertaking.

Nowhere in the 1958 budgets of the Air Force, Navy and Army will you find a replacement item as such. But defense officials give assurance that if Congress will go along with the replacement program, the money is there just the same.

And funds put aside for replacement of machine tools will not be "reprogrammed" for other use ("reprogrammed" is a fancy word for diverting the money to purchase of munitions, let's say).

The fact is that the replacement concept took hold in the services rather late for a full job to be done in fiscal 1958, Pentagon contends. But fiscal 1959 will be another story.

Many pool orders unsigned . . .

While the M-Day machine tool pool order program is making progress, machine tool builders have not rushed to sign contracts.

About 54 builders with orders valued at $156 million have returned their signed contracts, a recent check revealed. Ten builders proposed that certain changes be made before they were willing to sign. Some 26 builders, on the other hand, had not returned their contracts to Washington, either signed or unsigned.

The delay in contract-signing is not causing undue concern. Most of it is charged up to the feeling by builders that no urgency is involved and they will get around to the task of studying and signing the contracts as soon as they have time. Nevertheless, the government agencies concerned will feel better when the program is ready to go, with everybody signed up.

This is the first time in history that a pool order program has gone beyond the "paper" stage in peacetime. The estimated total program covers 95 contractors and 16,000 items worth $250 million.

The contracts are backed by $21 million earmarked and held by General Services Administration to cover the guarantees under the contracts. These guarantees are for GSA to take over any machines that cannot be sold and to help finance builders who need working capital to produce pool-order machines. Experience in World War II and Korea shows that the amount set aside now is ample to cover these contingencies.

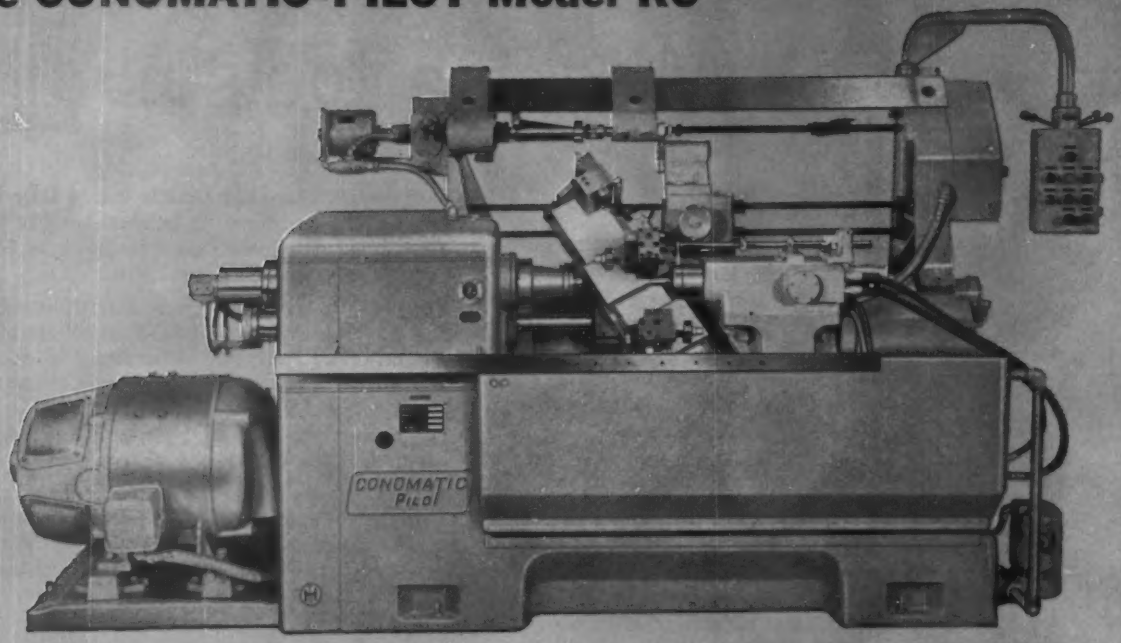
Bell buys Lake Erie Engineering . . .

Lake Erie Engineering Co has been acquired by Bell Aircraft and will be operated as a wholly-owned subsidiary of the latter, with no change in management. This is the second instance in the past year when a press builder has been merged with a company outside the machine tool industry. Hydraulic Press Mfg Co was taken over earlier by the Koehring Co. In October 1954, U S Industries Inc bought Clearing which now is its largest division.

Mergers still are a hot topic in the machine tool industry. Negotiations are quietly going on in two or three cases for the sale of family-controlled companies to firms outside the machine tool field.

More than that, a few builders are looking around for possible purchase of other builders or of companies in allied lines. In at least one instance, a builder is not interested in acquiring another manufacturer through exchange of stock. He wants to make any transaction strictly a cash deal.

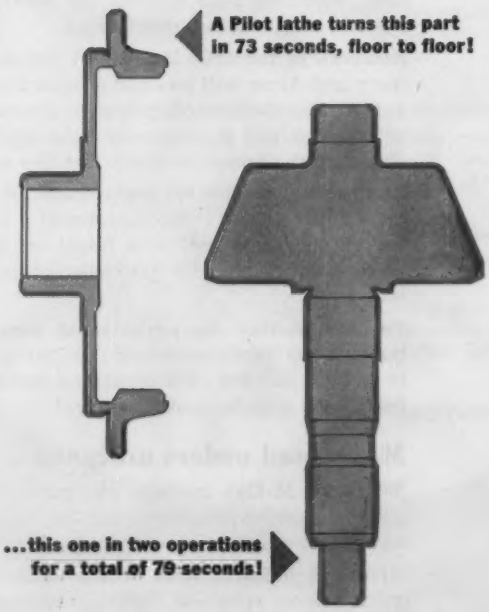
The CONOMATIC-PILOT Model KU



Cone Automatic is now manufacturing the world's most versatile copying lathe...

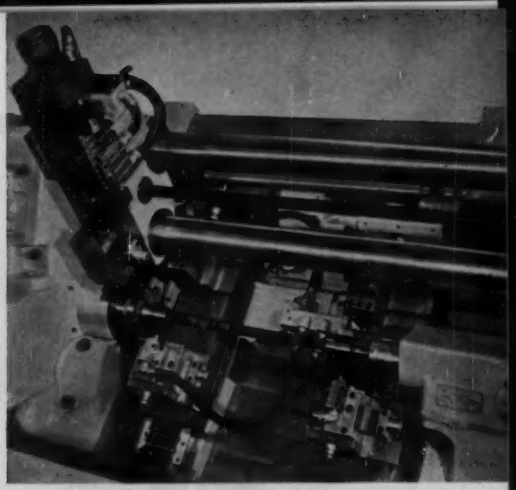
Cone Automatic Machine Company has acquired all rights to the manufacture and sale in the United States and Canada of the famous Pilot lathe. This hydraulically-controlled multicycling copying lathe has already proved its unique adaptability to automated production layouts in the plants of leading U. S. automobile producers and other manufacturers whose products require parts profile-turned to precise tolerances.

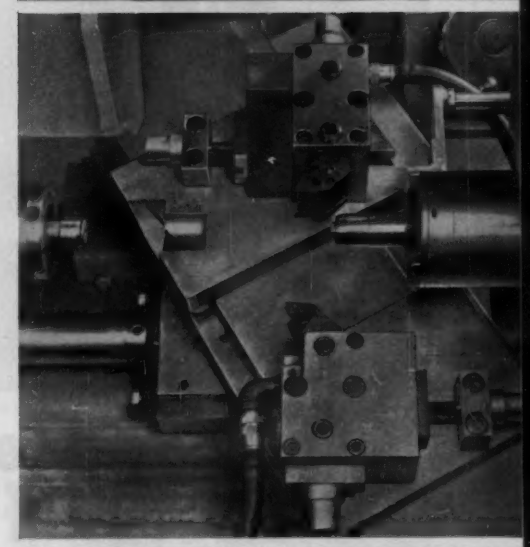
For more details, mail the coupon at the bottom of the right hand page today. We will send you a copy of the new Conomatic-Pilot Lathe Catalog. It's yours for the asking.

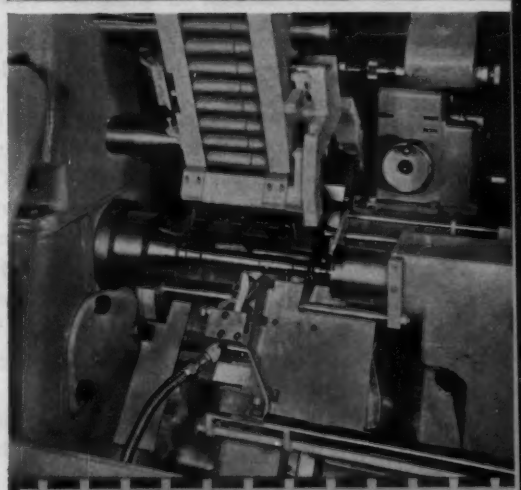


The Conomatic-Pilot KU offers:

- The advantage of a single-point copying lathe plus adaptability to virtually any number of tool stations. Top photo shows typical set-up.
- Smooth, even finish on all surfaces of the work piece: piloted hydraulic feed provides constant feed per revolution.
- Advantage of dual motion tool blocks when using 60° slide (see middle photo).
- Plenty of space near work area to mount automatic feeds and unloading systems. A typical automated arrangement is shown in the bottom photo.
- All cutting tools tangentially mounted for vibration-free operation.
- 45° inclined bed to ease chip removal—wear-proof nitrided steel slide ways.
- Rear tool blocks that can plunge-cut 90° shoulders or copy turn in reverse.
- Front and rear tool blocks that can copy different profiles from same motorized rotating template.







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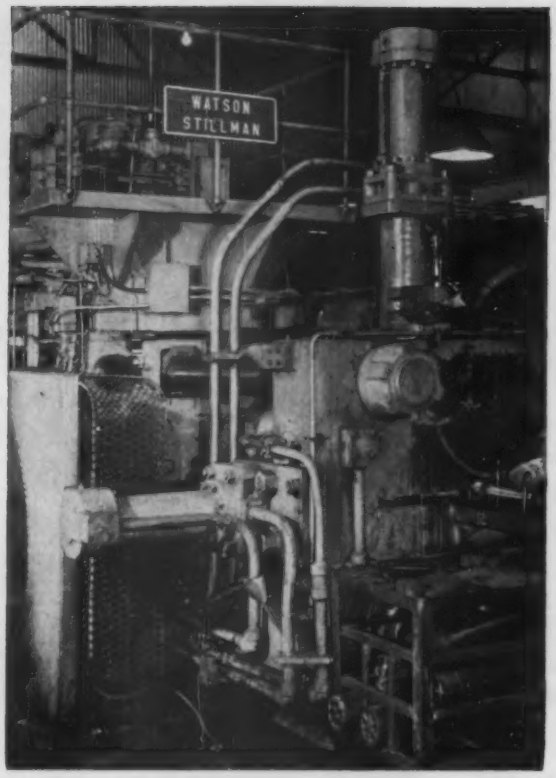

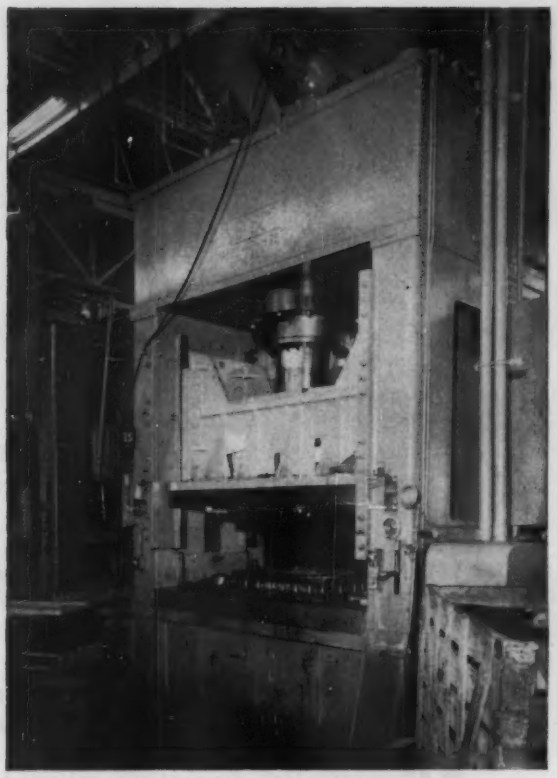

How to assure NO SLUDGE, NO RUST, NO FOAM in hydraulic systems

Here are two case histories of *Texaco Regal Oil R&O* and how it keeps sludge, rust and foam out of hydraulic systems. Names and details on request.

1. Even when the extrusion press (left, above) is on 24-hour schedules, the owner reports, operation is perfect with *Texaco Regal Oil R&O*. **"No stoppages, no delays in production, no trouble whatsoever. Periodic checks show the oil to be in excellent condition, without a trace of sludge. The entire system stays clean, free from rust and foam."**

2. After five years of operating the 500-ton press (right, above) on the original charge of *Texaco Regal Oil R&O*, the owner reported: **"In spite of the severe service we give it, the press has never had to be down for repairs and the hydraulic system has been completely free of sludge, rust and foam . . . the *Texaco Regal Oil* R&O as clear as that out of a new sealed drum."**

Tests prove that *Texaco Regal Oil R&O has more than ten times the oxidation resistance* of ordinary turbine-quality hydraulic oils — and far superior ability to prevent rust and foam. There is a complete line of *Texaco Regal Oils R&O* approved by leading hydraulic manufacturers for all types of hydraulic equipment.

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TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

What's ahead ... in Metalworking

NEWS REPORT

Production to be big for some time . . .

Metalworking manufacturers have little if anything to complain about production-wise. Plants are running full, or close to it, many of them (especially in the capital goods field) on two shifts with considerable work farmed out.

This happy situation promises to continue for some time. But everything isn't rosy. Orders have not been keeping pace with shipments in heavy goods and in some consumer lines, such as household appliances and TV sets.

There is no alarming drop in sales, however. They still are high by all standards except the extraordinary period of the past year.

Automobile production, though pretty good, is not living up to expectations. Based on what has happened thus far in the 1957 model year, auto parts people are paring their ideas a bit for March and April. They say, however, that the situation could change for the better almost overnight.

Steel demand eases further . . .

Demand for steel continues to ease, with only plate, structurals, oil-country pipe, and furnace or heat-treated bars in short supply. Shipments of most steel items in February have been very high, but there is bound to be a letup in light gage cold-rolled sheet in March unless Detroit buying increases.

Auto makers have been so niggardly in taking steel that mills wonder where Detroit is getting all the steel it is chewing up. Orders for sheet and strip have been so reduced in tonnage lately that at least one big mill has resorted to making light plate on part of its sheet and strip facilities.

Some steel warehouses have been enjoying the largest business in history. Sales in certain cases have been running 20% ahead of the fourth quarter's volume. Warehouse inventories of some items (like sheet, strip, cold-finished bars) are reported above normal.

Diesel locomotive business good . . .

Freight car buying by railroads has been less than anticipated. Result is that car builders are eating into their backlogs. Nevertheless their plants will be operating at or close to current satisfactory rates through the entire year.

New passenger car business is virtually nonexistent. This is not a new development but a continuation of a condition that has prevailed for some time.

Diesel-electric locomotive orders have been exceptionally good, Electro-Motive Division of General Motors. Export and rebuilding sales have risen markedly.

Some 10% out of 296 member shops polled by the National Tool and Die Manufacturers Association view prospects as excellent, 63% say that they are good, 23% fair, and 4% poor. A year ago 16% saw the outlook as excellent, 57% as good, 25% as fair. The bigger, better-equipped, better-known tool and die shops are reported busy, some having just received big tooling programs. Smaller shops are having to do more scrambling for business than they did last year.

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AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JAN. Estimated	DEC. Preliminary	NOV. Revised	DEC. Year Ago
Total Index	**181**	**181**	**181**	**170**
Machinery	154	154	154	147
Electrical Machinery	215	217	196	
Autos	150	152	152	
Other Transportation	338	336	298	
Other Metalworking	145	144	140	

NEWS REPORT What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JAN. Estimated	DEC. Preliminary	NOV. Revised	DEC. Year Ago
Total Index	**151.5**	**151.1**	**150.5**	**141.5**
Metalworking Machinery	**174.4**	**174.4**		**160.9**
Other Machinery exc. Electrical	**159.5**	**159.0**		**148.1**
Electrical Machinery	**152.0**	**151.4**		**137.8**
Fabricated Metal Products	**143.2**	**143.3**		**136.0**

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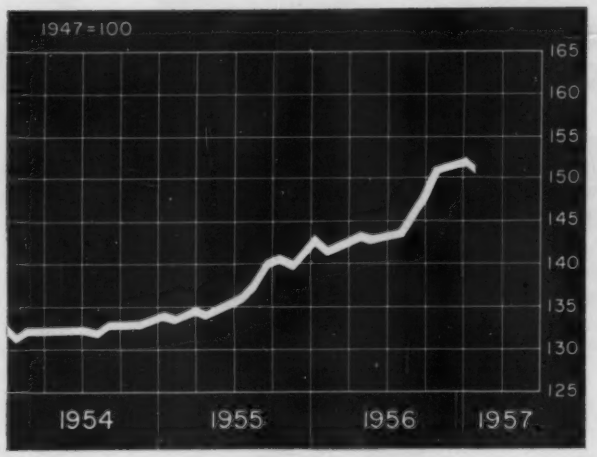

No recession in the cards for 1957 . . .

There is little or no chance of a recession this year, despite the gloom that hangs over Wall Street these days. Although some business indicators suggest the possibility of a leveling off the latter part of the year, it will be just that and no more.

One reason why the economy is healthy enough to withstand any stock market setbacks is the rise in consumer income. Personal income, which hit an all-time record $333.5 billion at 1956's end, continues to increase—and that means more consumer buying. Too, upcoming labor contracts call for still more increases, and reports from around the country indicate that industry is planning to increase employment, rather than decrease it as is usual for this time of year.

Another healthy economic sign is heavy industry's current ample backlog of orders, which in itself is so strong that even if new orders were to drop off sharply, the effect on production probably wouldn't be felt until next year. And it is this heavy industrial backlog that in turn is keeping the basic metals industry humming.

Defense expenditures, too, are bound to rise this year, no matter how much is cut from the latest budget. The signs are clear that defense spending is on a steady rise, and that it will continue to follow this pattern for a few years anyway. The complexity of new weapons can mean only one thing—increased cost to the government and more business for defense producers.

Dollar volume of construction, a reliable business bellwether, looks as though it will top last year's, athough physical volume may be a shade lower. Highway construction, too, will be rising for several years. Only current weak spots in construction appear to be industrial building and housing.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	151.0	151.5	150.9
Steel ingot production (thousand tons)	2,469	2,485	2,433
Electric power output (million Kilowatt hours)	12,322	12,410	11,540
Production of automobiles and trucks	178,767	173,063	165,110
Engineering construction awards (Eng. News-Record, millions)	57,045	58,017	74,063

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	200	201	235
Vacuum cleaners sales (thousands of units)	300	372	308
Washers sales (thousands of units)	358	449	361
Household electric ranges sales (thousands of units)	79	76	88
Radio production (thousands of units)	1,382	1,349	1,581
Television production (thousands of units)	680	821	632
Gear sales index (1947-49=100)	235.7	216.2	245.5
Foundry equipment new orders index (shipments, 1947-49=100)	121.0	122.2	154.4

* Seasonally adjusted

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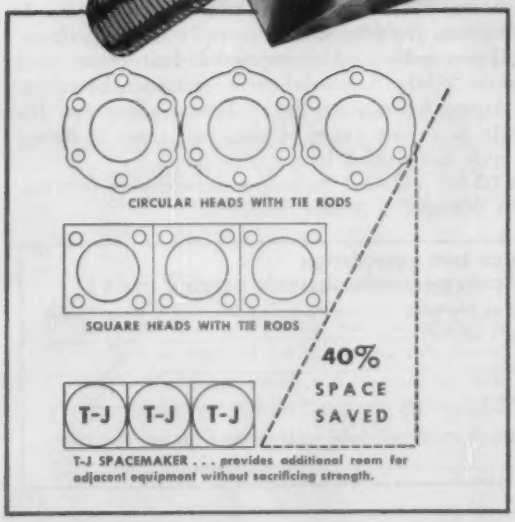

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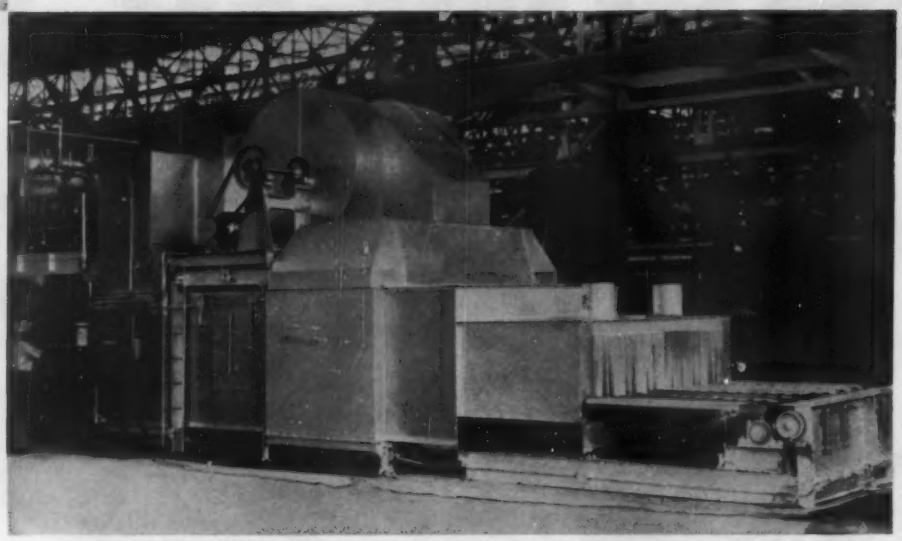

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Designers utilize unique combination of resistance to heat and corrosion, high heat reflectivity and economy offered by special aluminum-coated Armco Steel.

Armco ALUMINIZED STEEL® Type 1, sheet steel hot-dip coated on both sides with aluminum, combines the surface characteristics of aluminum with the mechanical properties of steel. It offers product-improving advantages unobtainable with either metal alone.

High Heat Reflectivity—Up to 900 F, ALUMINIZED STEEL Type 1 reflects about 80% of radiant heat. You can keep heat where you want it, achieve greater efficiency.

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Low Cost—Combining the advantages of two metals in one, ALUMINIZED STEEL can reduce your material costs. It costs less than any other metal that can equal its performance. If you make products exposed to heat—from small appliances to large industrial ovens—consider the advantages Armco ALUMINIZED STEEL Type 1 offers you. It's available in a wide range of sizes and gages in sheets, sheet coils and welded tubing.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

How Does Your Shop Measure Up?

Some businessmen seem to scare easily these days. Every item of unfavorable news gets a thorough working over in conference and across the luncheon table.

Perhaps this is a natural reaction to the current situation. New orders, though excellent by historical standards, are not quite up to last year's boom volume. Credit is not as plentiful as it was. The stock market has been gyrating, mostly downward. The cost of doing business has been mounting painfully, and profit margins accordingly are suffering.

It is a seller's market . . .

no longer. Production has pretty well caught up with consumption for the time being. And in many lines an excess of productive capacity exists.

The main job from now on is to sell. But management's task does not end there. Management must look ahead to the maintenance of its competitive position. It cannot suddenly cease to pour money into its operations just because expansion is not a problem.

It must develop, produce and market new products. It must revamp old ones. It cannot afford to stand still. It is, in fact, confronted by an even more compelling reason for making judicious capital outlays.

Take Westinghouse. It plans . . .

to spend $75 million this year, compared with $50 million in each of the preceding two years. But of the total, only one-fifth will be used for new plants. Four-fifths, or $40 million, will go for new equipment, mostly automatic, and for improvement of existing equipment.

Rising manufacturing costs is the reason for the emphasis on automatic equipment. Westinghouse is determined to hold them down.

Westinghouse's capital spending thus is to be largely used for improvement of present manufacturing methods rather than for building new plants. Replacement and modernization provide the theme. Lurking in the background is the practical aspect of the matter: cost cutting.

What Westinghouse is doing every metalworking manufacturer should be doing, and many are. This is the time when management should put the microscope on its shop operations to see exactly what kind of job is being done and whether the cost of doing it is reasonable.

Is each production worker . . .

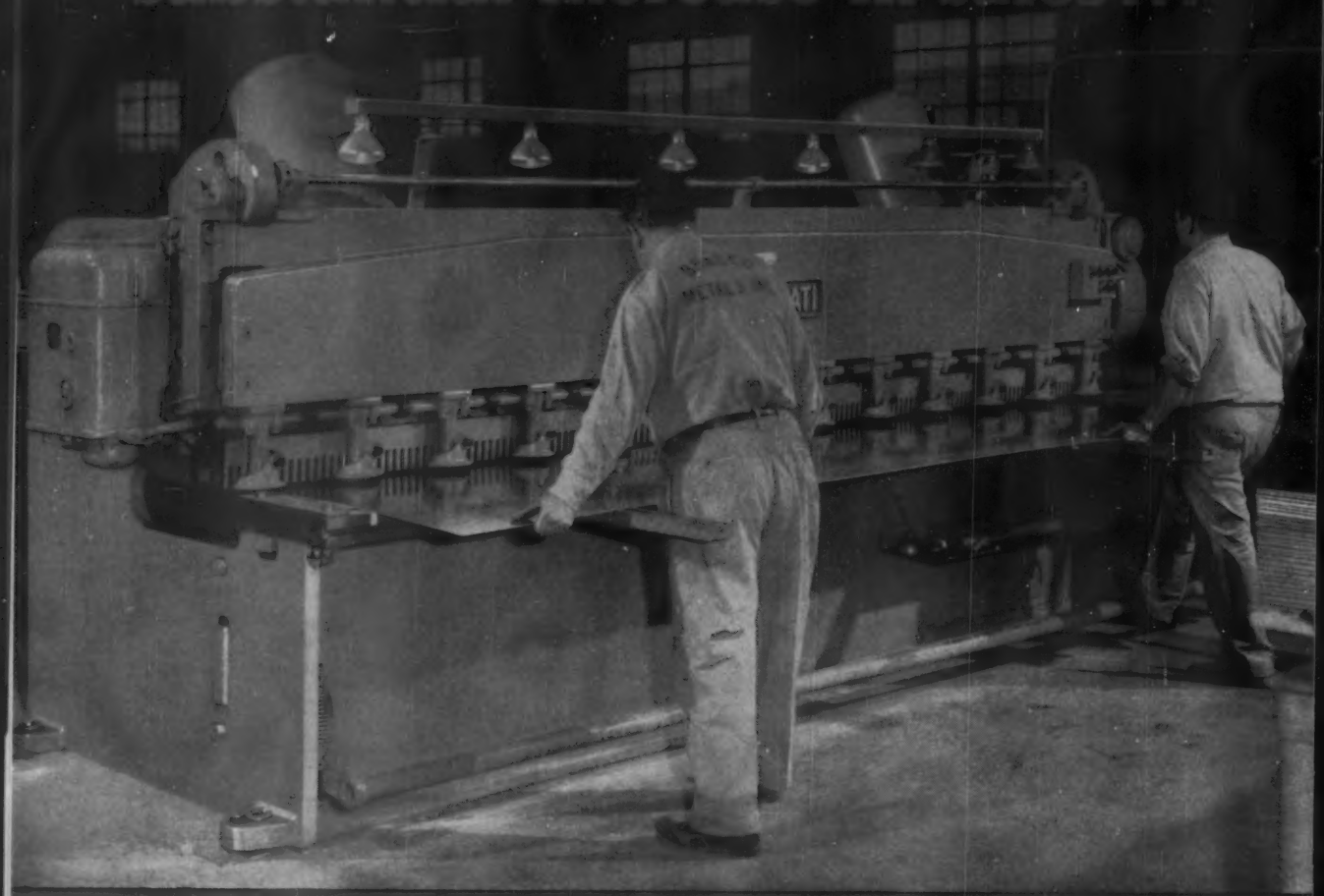
being given adequate mechanical help so that you are getting from him maximum output without unduly taxing him physically? To what extent can you secure a better product in larger quantities by making your manufacturing processes automatic?

How do your machines measure up, on a cost basis, for the work that they are doing, against the new machines now available on the market? Are you making use of the new materials as they are perfected, both for cutting metal and for fabrication into end products?

The end of the easy-to-get-business era is here. From now on, competition will be hard-hitting. This competition will be not only in actual selling, but also in the pricing of products. That in turn means that cost-cutting will be put under a withering spotlight. Just what kind of a performance can your shop turn in when the spotlight is focused on you?

Burnham Finney EDITOR

Accurate CINCINNATI SHEAR brings substantial increase in sales . . .



at BRALCO METALS, INC., Los Angeles, California

Micrometer accuracy in squaring, notching and slitting of aluminum sheet and plate makes this Cincinnati Shear a profitable producer. The Bralco Company states, "There is no question that this Shear has been responsible for a substantional increase in our sales." Maintained accuracy is insured by hydraulic holddowns, low rake upper knife, inclined ram and all-steel, weld free construction.

The 1412 Series Cincinnati Shear is shown shearing aluminum sheet. High pressure hydraulic holddowns automatically clamp different gauges of metal with the same pressure.

Write **Department A** for Shear Catalog S-7R. We also suggest that you contact our Application Engineering Department for information on your shearing problems.

Photo courtesy Bralco Metals, Inc., Los Angeles 23, California

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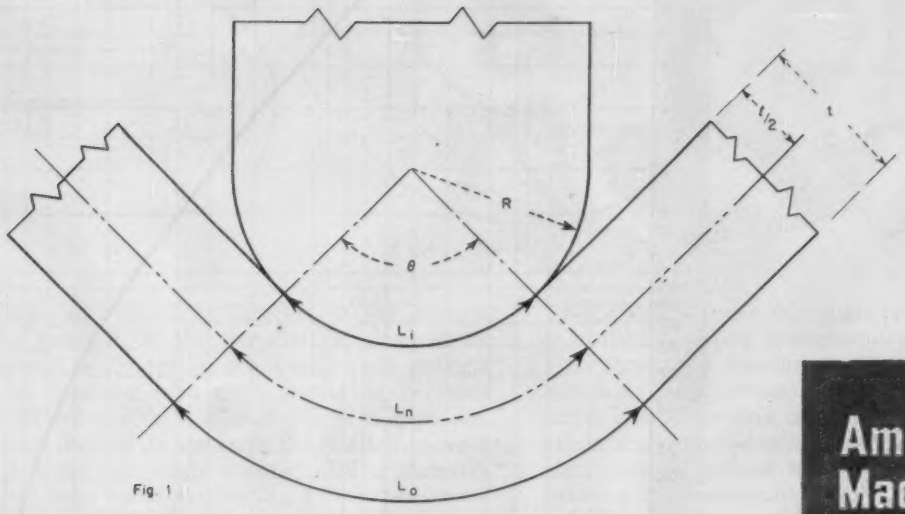


Fig. 1

American Machinist

Formability Index determines minimum bend radius

WILLIAM W WOOD, supervisor, Manufacturing Research
CHANCE VOUGHT AIRCRAFT, INC, DALLAS

Efficient aircraft design requires that the bend radius on parts be maintained at a minimum. Forming limits should be based on an absolute figure obtained from some consistent property of all materials. Formability indexes, worked out and checked by experiments, show that airframe manufacturers' standards for minimum bend radiuses are too conservative. These indexes can be used, too, by other shops doing press-brake forming

Costly experiments are usually employed to determine minimum bend radiuses for sheet-metal parts formed on press brakes. Data so obtained will vary with source, and will often involve too large a factor of safety at a sacrifice in airframe efficiency.

When data on minimum bend radiuses are developed at various locations, there are bound to be significant differences in the results. Physical properties of the materials may vary in a normal manner. The extraordinary variations cover a lot of ground: (1) grain directionality, (2) the number of good samples obtained for a given punch radius and material thickness, (3) the blank size, and (4) the type of punch and die employed in the test setup.

How can we avoid the practice of testing samples?

The answer lies in developing a "formability index" that is based on *known* mechanical properties of the material. This index is E/S_{ty}, where E is the true natural strain, and S_{ty} is the tensile yield strength.

Three further questions arise:

1. What is the value of E?
2. What is the validity of E when used to calculate the formability index?
3. How can we find the minimum bend radius of a material for which the formability index and the thickness are known?

What we are seeking is a simple means of finding R, the minimum part or punch radius at which splitting does not occur in a given material with a thickness t. By mathematical reasoning and supporting results from 1320 test samples, two nomographs have been developed and can be used respectively to solve R/t for the

FORMABILITY INDEX . . .

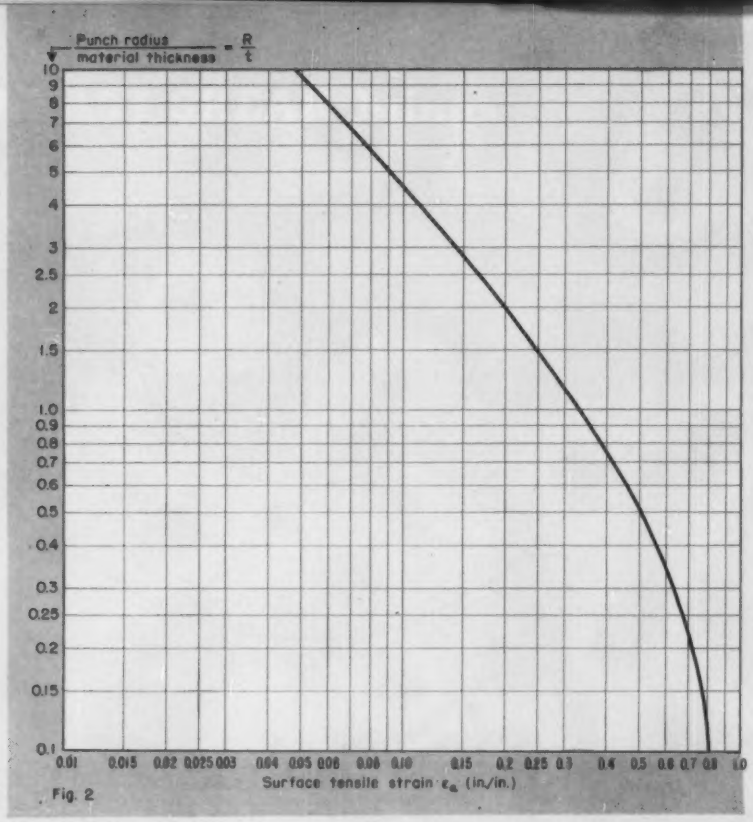


FIG. 2 ▶ Fig. 2

absolute minimum bend radius and the other provides an R/t ratio that is 40% higher so that there will be no chance of producing scrap.

THEORY OF MINIMUM BEND RADIUS

Brake forming produces strains across the thickness of the material, Fig. 1. The neutral axis is assumed to lie in the middle plane of the material, but this is not exactly true. Actually, the neutral axis moves toward the compression surface by about 5 to 10% for steel and aluminum, and toward the tension surface by about the same amount for magnesium. The inside and outside fibers within the segment angle Θ were originally the length of the neutral axis, L_n, but have shortened and lengthened to L_i and L_o after brake forming.

Because fractures occur only on the tensile side, let us consider strains on the outer surface only. The average tensile strain here is the final length minus the original length divided by the original length:

$$E_a = \frac{L_o - L_n}{L_n}$$

$$= \frac{(R + t)\,\Theta - (R + t/2)\,\Theta}{(R + t/2)\,\Theta}$$

$$= \frac{t/2}{R + t/2}$$

$$= \frac{1}{2\,R/t + 1}$$

The significance of this equation can be realized by drawing a graph, Fig. 2, and determining the limits. For $R/t = 0$, the value of $E_a = 1$, while for an $R/t = \infty$, the strain $E_a = 0$. Thus, strain of 100% is the greatest that can be obtained in brake forming, and this strain can be reached only when the punch radius $R = 0$. In other words, when a part is bent 180° and hammered to a zero radius on the inside, we have 100% strain in the outer fibers regardless of the material gage, Fig. 3.

For this reason, any material that has a true natural strain of 100% (as in some very soft aluminums and steels) does not have a minimum bend radius. Such materials can be bent double and hammered and will not split.

Because there is no strain on the tensile surface in a direction perpendicular to the above strain (i e, in the direction of the bend), we have a uniaxial strain condition analogous to a tensile test on sheet material. There is, of course, a strain in the direction normal to the outer surface and is noted by a "necking" or thinning of the thickness of the sheet.

If the surface of the material could be perfect, free from scratches and imperfections, it would probably thin uniformly around the bend, and the true natural strain would be the limiting parameter for cracking. Actually, it is possible that the true strain might be exceeded, because we are bending in brake forming. The average tensile strain from the neutral axis to the outer surface, Fig. 4, is one half of the surface strain, so that if no stress concentrations were present, the true strain on the surface could be doubled. However, because of the notch sensitivity of materials, this is not likely. The final fracture strain will probably fall between the region of somewhat above to somewhat below the true natural strain.

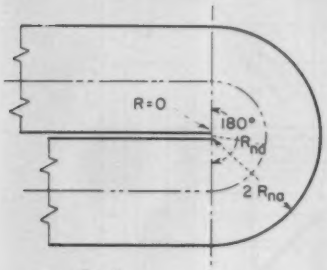


Fig. 3

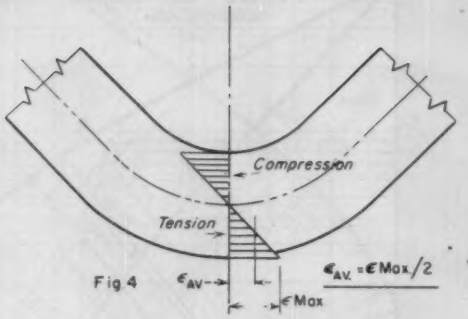


Fig 4

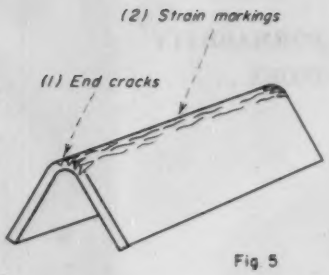


Fig 5

Notch sensitivity is a function of the strength of the material. If the true natural strain E for a material is divided by the tensile yield strength S_{ty}, the resulting ratio E/S_{ty} should be an index as to the relative brake formability. It is of no consequence that we do not know the relation between the strength and notch sensitivity of a material; this has been found empirically with experimental brake-formed samples for materials. Table I gives the formability indexes for these tested materials and a number of others.

The above discussion is related to final fracture in the middle portion of the tension surface away from the ends. Usually, two other conditions resulting in an unsatisfactory part will occur first, however, as shown in Fig. 5. These are (1) cracks on the tension surface on the ends, and (2) strain markings ("orange-peel" and "Lueder's lines") on the tension surface in the middle region.

Actually, the end cracks are harmful only if a part is trimmed to size before brake forming. Most parts, at least those that are to have a subsequent forming operation, are usually trimmed after brake forming, so end cracks would be of no consequence.

Strain markings are detrimental only in that they are an indication of non-visible cracks. A study made with crack-detecting equipment discloses that, unless the strain markings are extremely severe, no cracks will occur.

In materials that have been hardened by cold work, the minimum bend radius is larger when the bend is parallel to the grain. This is true because there is less available strain across the grain than with the grain, after the grains have been elongated by rolling.

EXPERIMENTAL RESULTS

Seven materials in all gages between 0.016 and 0.250 in. were sheared into 3x3 in. blanks and formed to 90°. In all, 1320 samples were made to determine the limits of cracking on the tension surface in the middle region away from the ends.

In testing a given material, each selected punch radius R was checked against five samples of increasing thickness t. The formed parts were classified as "good" and "bad." Test results for each material were plotted as in the example shown in Fig. 6. A trial line was drawn so that as many good parts lay to the left of the curve as bad parts lay to the right. Note: the slope of the curve varied with the material, but in all cases the plots were straight lines, except for very thin gages (0.016 in. and less), indicating a purely geometrical relationship.

To develop a nomograph (Fig. 7) for absolute minimum bend radiuses for all materials, two abscissa scales are laid out for the surface tensile strain E and the formability index E/S_{ty}. The ordinate scale is laid out for values of R/t. Steps in drawing the nomograph are:

1. The experimental R/t ratios were plotted as points on the chart where the ordinate (R/t) crosses the curve $E = \dfrac{1}{2R/t+1}$

2. Curve 1 is a plot of the equation $E = \dfrac{1}{2R/t+1}$ and is the same as the one shown in Fig 2.

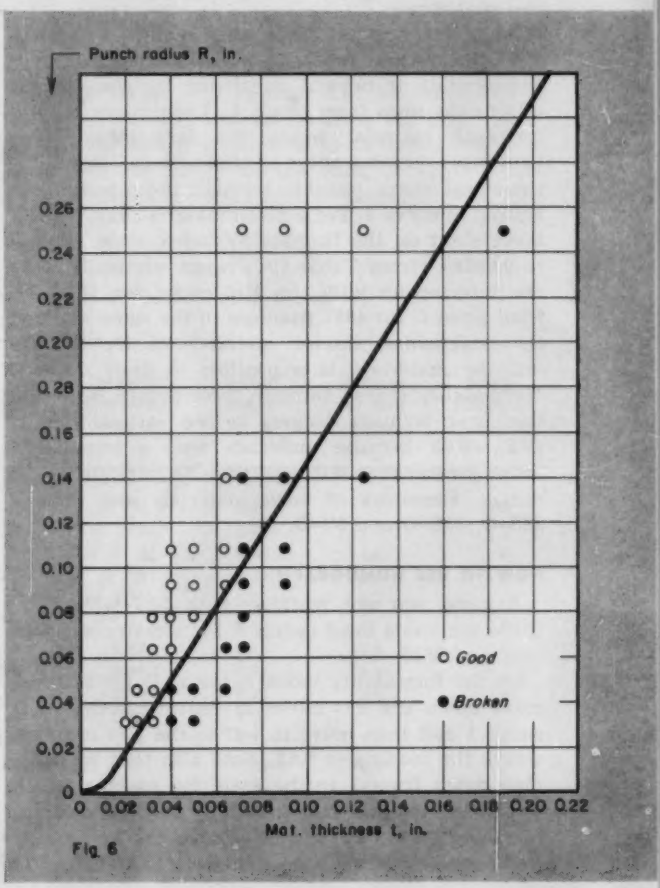


Fig. 6

FORMABILITY INDEX . . .

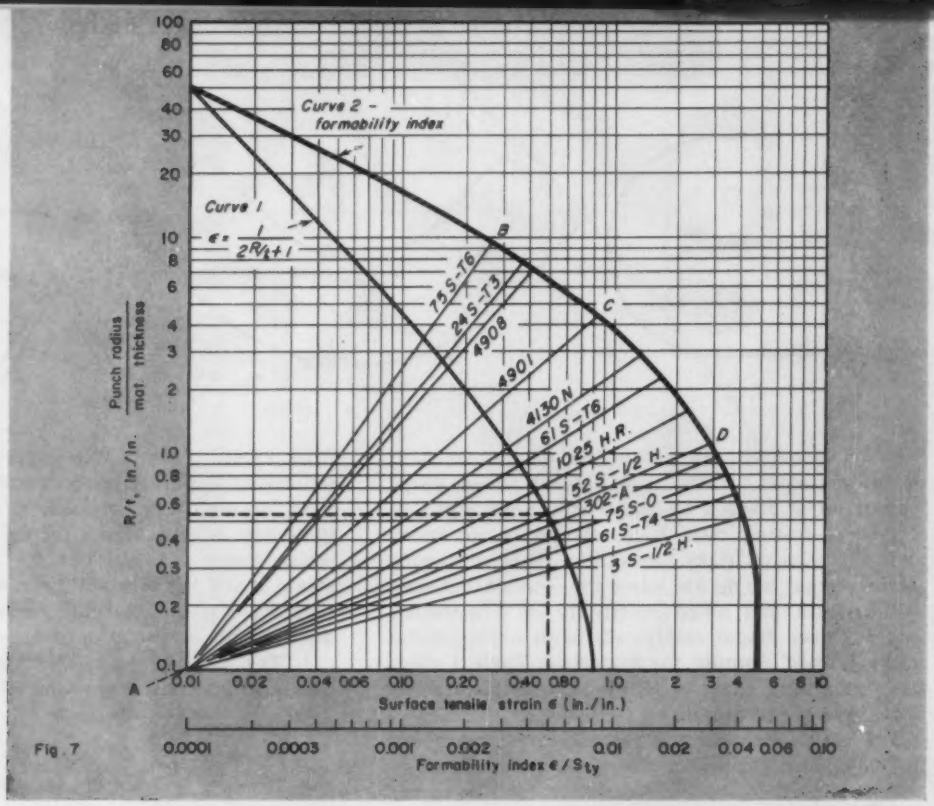


FIG. 7 ▶ Fig. 7

3. The formability index (curve 2) is plotted in this manner:
First, draw straight lines from point *A* through the experimental point for each material on curve 1 extending it beyond as shown by the fanning of straight lines from point A. Then, place a point for each material where the formability index (abscissa) crosses these straight lines. Draw the smoothest curve possible through these points, resulting in curve 2. For a given material, say 75S-T6, move right on the formability-index scale (E/S_{ty}) to 0.00264 (from Table 1). Project vertically to *B*, the intersection with the *R/t* curve for 75 S-T6. Find point *C* for 4901 titanium in the same manner. By establishing similar intersections for the remaining materials, it is possible to draw curve 2 (formability index) through these points. Note that the curve is made tangent to the vertical line at $E/S_{ty}=0.05$, because materials with a formability index greater than 0.05 will have no minimum bend radius. Examples of such materials are: 24S-O, 52S-O, 61S-O and 3S-O.

HOW TO USE NOMOGRAPH

Assume you are working with 52S-½H. What is the minimum bend radius *R* for a material thickness $t=0.051$?

On the formability index curve at *D* for 52S-½H move down the *R/t* curve to its intersection with curve 1 and then move to left to the *R/t* ordinate, where the reading is 0.52. Note also that by dropping down from 1 to the scale for surface tensile strain, we find that E = 0.50. Now if $R/t = 0.52$ and $t = 0.051$, $R = 0.051 \times 0.52 = 0.0265$ in.

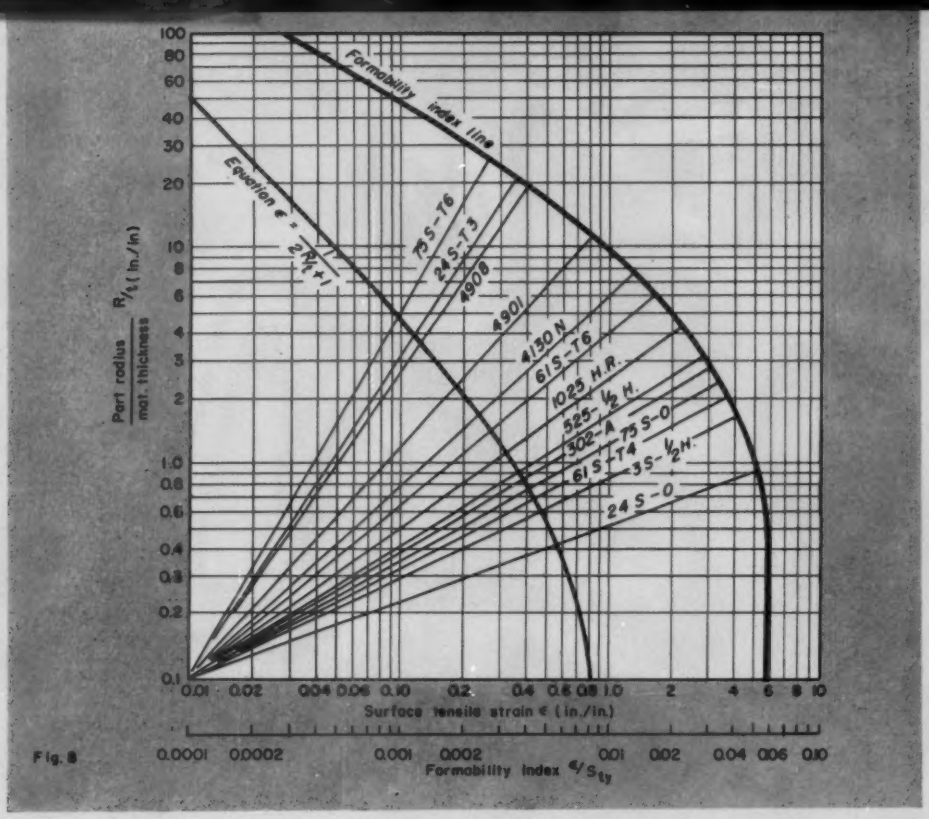
If you are dealing with a material not charted on the nomograph, calculate its E/S_{ty}, project vertically from that value to curve 2, and thence to *A*. Where the *R/t* curve cuts curve 1, project left to find the *R/t* ratio, and solve for *R*.

It is to be expected that a certain percentage of parts will not form properly when made with a minimum bend radius selected with the aid of the nomograph in Fig. 7. This graph represents the absolute minimum bend radius for a material with

TABLE 1—FORMABILITY INDEXES OF VARIONS MATERIALS

Material	True Strain E, In. per In.	Average Tensile Yield* S_{ty}	Formability Index E/S_{ty}
75S-T6	0.19	72	0.00264
4908	0.51	125	0.00408
4901	0.69	82	0.00840
413ON	0.99	75	0.01320
61S-T6	0.67	40	0.01670
75S-0	0.51	15	0.03400
24S-0	0.56	11	0.05100
24S-T3	0.19	52	0.00365
1025 H.R.	0.87	39	0.02230
52-1/2H	0.89	31	0.02860
302 A	0.92	30	0.03060
61S-T4	0.78	21	0.03700
3S-1/2H	0.78	19	0.04100
52S-0	1.14	12	0.09500
61S-0	1.38	8	0.17200
3S-0	1.24	6	0.20600

The materials above the dotted line were used for experimental samples while those below were not.
*** In 1000 psi**



◀ FIG. 8

nominal properties. To avoid scrap, the designer should use a safety factor. Fig 8 is a nomograph derived by increasing the absolute values by 40%. But even when using this chart, the minimum bend radius will be smaller than obtained by conventional industry standards. Table II discloses that for the soft aluminums, the safety factor is roughly 18 times, but the hard aluminums are reasonably close to values obtained from Fig 8.

It is recommended that the minimum bend radius be computed for all materials from Fig 8 with the following reservations: (1) For a production deburr, 24S-O and 75S-O parts will have a minimum bend radius of 2.0 ($r/t = 2.0$) instead of the values shown on the graph. (2) The values from Fig 8 are satisfactory for 24S-O and 75S-O parts that are to have a full round deburr on the ends, or parts which will be trimmed subsequent to forming.

TABLE 2—COMPARISON OF INDUSTRY STANDARDS WITH EXPERIMENTAL VALUES OF MINIMUM BEND RADIUS R/t

Material	Airframe Manufacturers A	B	C	D	E	Theoretical & Minimum Fig 7	Design Values Fig 8	Average for Five Companies	Safety Margin of Companies
3S-0	1.7	1.8	2.0			0	0.10	1.8	18.0
61S-0	1.7	1.8	2.0		1.3	0	0.20	1.7	8.5
52S-0	1.7	1.8	2.0			0	0.30	1.8	6.0
24S-0	1.9	1.8	2.3	1.4	2.7	0	0.42	2.0	4.8
35-1/2 H		3.4				0.31	0.60	3.4	5.7
61S-T 4	1.7	2.6	2.0		1.3	0.37	0.68	1.9	2.8
75S-0	2.0	2.3	2.3	1.4	3.0	0.42	0.75	2.2	3.0
302-A	1.8	1.0	1.1	1.0	1.0	0.48	0.83	1.2	1.5
52S-1/2 H		3.4				0.52	0.90	3.4	3.8
1025 H.R.						0.68	1.10		
61S-T6	2.6	3.4				0.88	1.40	3.0	2.2
4130 N	3.5	2.2	1.5	3.0	2.0	1.05	1.65	2.4	1.5
4901	4.0					1.60	2.25	4.0	1.8
4908	4.0					2.50	3.60	4.0	1.1
24S-T 3	3.4	3.4	3.0	2.8	3.0	2.70	3.90	3.1	.8
75S-T6	7.0	5.0	5.0	5.3	5.3	3.40	4.70	5.5	1.2

Titanium aft section of the Crusader . . .
contains most of the 650 lb of titanium included in the plane. An example of the producibility approach is the power control package which can be seen just above the horizontal tail that it controls. The package contains the power cylinder, valves, and feedback mechanism; is assembled and tested before mounting in the plane

26 MONTHS FROM FIRST FLIGHT TO LINE PRODUCTION . . .

Production Planning for the Crusader

Advance planning by engineering and manufacturing helped speed the supersonic Navy F8U-1 into production. Here are the producibility philosophy behind the plane and key examples of the production methods that resulted

JOHN R SAUL, producibility engineer,
CHANCE VOUGHT AIRCRAFT, INC, DALLAS, TEXAS

The F8U-1 Crusader will reach operational squadrons of the Navy next month, only a little more than two years after its first test flight. Effective advance planning by engineering and manufacturing helped the plane set this exceptional record. As a result, high-quantity expansion was not deterred by necessity for the usual production redesign. All major aspects of the production article are the same as the experimental airplane.

An important point in the producibility philosophy was the emphasis on good accessibility, grouping of plumbing and wiring, and application of the package concept to system components.

Much effort was given to improving production

and maintenance through good accessibility and the grouping of installations other than the plumbing and wiring. Numerous access areas were provided in the basic layouts, and designers made extensive use of the package-system concept in hydraulics, controls, electrical, and other systems.

These components could then be assembled, tested, and fully adjusted while on the bench. When installed on the assembly line or replaced in the field, they have several advantages:

a. Readily accessible
b. Fewer attachments
c. Little or no adjustment
d. Reduction of skilled labor requirements

An example of this application is the horizontal-tail power-control package which includes the power cylinder, valves, and feedback mechanism. After the panel is removed, less than a dozen bolts and hydraulic connections need to be disconnected for removal of the unit.

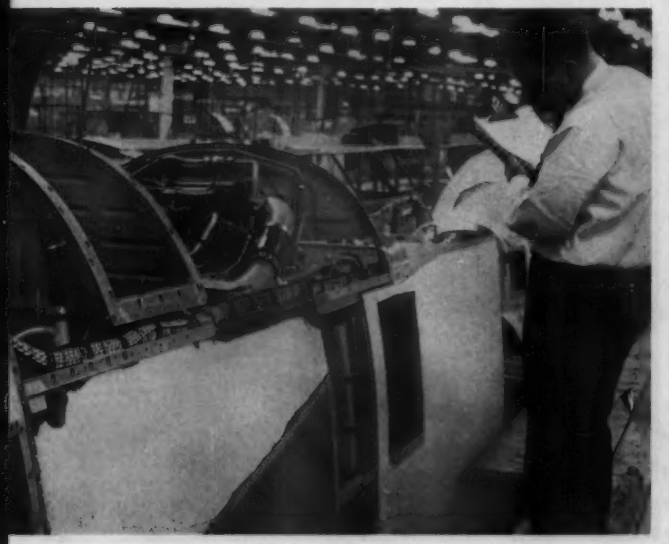
Tool project engineers were in close contact with the design at all times, working with the designers, producibility, and structural personnel to determine the optimum breakback of each assembly at a minimum of weight and cost. And, as the airplane design progressed, the manufacturing department was developing the jigs, fixtures, and workstands necessary and preparing exact scale models of these items.

From the models, planners could better visualize means to the best sequencing of operations and call attention to potential bottlenecks before production began. The scale models paid for themselves many times over through elimination of airplane and tooling rework and re-sequencing of operations.

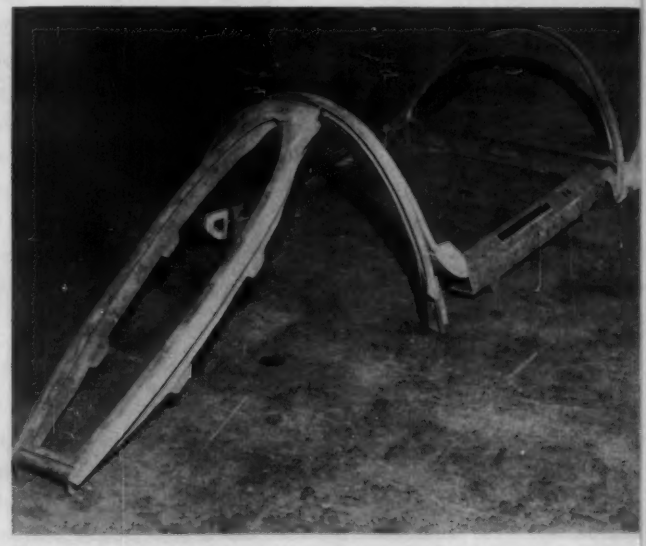
Miniature jigs for planning . . .
surround the model of the F8U-1 studied here by Dan Gilmore, factory manager, and K G Smith, chief tool engineer at Vought. Other models line shelves in background

Miniature assembly lines, enclosed in clear plastic to permit viewing from all angles, were prepared when it first appeared that the full production program would be realized as originally planned. The models were used in development of new fixtures and for research to determine the best use of existing facilities for future expansion of the production line to even higher rates.

Engineering and manufacturing teamwork made



Channel on each side of mid-section . . .
carries bundles of wires running from cockpit, eliminating the feeding of wires through bulkheads. With this arrangement, wires can be laid out on an assembly board and checked on a simulator, then bundled and placed in plane as a unit.



Six magnesium castings form canopy frame . . .
and windshield assembly. Canopy castings include the front hoop, the rear hoop (including canopy hinges), and two box-section side rails. Two additional castings form the windshield frame in foreground. This construction eliminates the parts, weights, and operations of conventional built-up structure.

Production Planning for the Crusader. . .

important contributions to the Crusader producibility through efficient use of castings, large forgings, processes such as chemical milling, and new materials such as titanium alloy.

A total of 650 pounds of titanium and titanium alloy are designed into the F8U-1. Some of this material appears throughout the airplane in the form of high-strength, light-weight fasteners. The major portion, however, is to withstand the intense heat generated in the aft section by the J57 engine. Here the alloy is formed into bulkheads, support members, and spotwelded external skins.

Both forming and spotwelding of titanium alloy presented a mountain of problems at the start. Ground rules required the initial design to be a production configuration, yet little information was available on this material and most of it was very discouraging.

A particular case in point is the spotwelding of titanium alloy AMS-4908. Although all reports from material vendors and other aircraft companies indicated that successful spotwelding of this alloy could not be done, Chance Vought believed otherwise. Development work began in 1951 and results showed that, contrary to other reports, spotwelding could be done with a low tension-to-shear ratio.

This data was applied to the F8U-1 aft section design and resulted in a weight saving, elimination of hot dimpling, and more total attachment strength.

Many potential production bottlenecks were avoided by designers through effective use of ferrous and non-ferrous castings. In magnesium alone, there are 275 sand castings being used which range in weight from a few ounces to 13 pounds. Wall thicknesses of 0.10 in. are not uncommon in the non-ferrous alloys, and many of the gaps on parts such as bellcranks are held to a design tolerance of 0.010 in. by the casting vendors. This permits the parts to be installed with only a hole-drilling operation required.

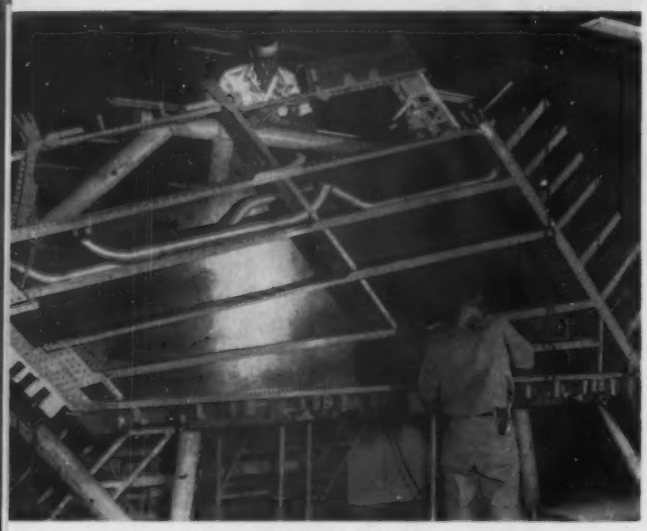
Large, complex non-ferrous castings are used effectively in several places. A portion of the engine air duct contains integral stiffening flanges as part of the casting. A major advancement in casting application, this casting saves many parts and operations along with a significant amount of weight.

Precision steel castings also played an important part in the design and production of the Crusader. Approximately 35 different castings, most of them heat-treated to 180,000 psi minimum tensile strength, are used on the airframe itself. Another 25 different precision-cast steel parts are used for special support equipment.

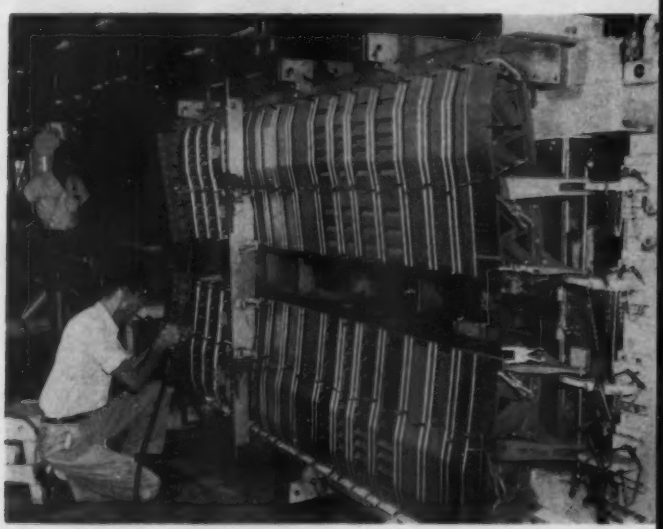
On almost all of these steel castings, no machining operations other than hole drilling are required. Not only is the reduction in machine shop time obtained by the cast method significant, but in some instances no other method could accomplish the job within the space and weight limitations.

The use of 260,000-280,000 psi heat-treat steel plays an important part in the F8U-1 production. Personnel in engineering and manufacturing research worked closely to develop the necessary data for using this material and this resulted in almost 50 different high-strength parts being incorporated on the airplane. Here again, excessive parts and weight are eliminated.

Workstands on the final assembly line make optimum use of the many access areas provided. Installation of components on this line is kept to a minimum and restricted to major assemblies and final checkout of systems.



Assembling integral fuel tank . . .
in the wing center section. After the two wing stubs are joined and sculptured skins are installed, the sealant is injected into a continuous groove on the sub-assembly line with a sealant gun. There is no internal access to the fuel cavity during or after the sealing operation



Extruded rocket tubes . . .
are assembled into the rocket packs. Extruded walls are thicker than structurally required, so the extrusions are thinned by chemical etching. An almost invisible tube seam was amplified by the chemical solution, but this problem was corrected by modifying the extrusion die

Modern Management for the small plant

American Machinist

SPECIAL REPORT NUMBER 439

SPENCER A TUCKER and ARTHUR WILKENS, Principals

THE CLEMENT MOORE ASSOCIATES, management consultants, NEW YORK

Control in the small-to-medium-size business is becoming an increasingly difficult problem for the manager wearing many hats. It never was easy and now it is almost impossible to: run the shop, sell the product, purchase the materials, follow the paperwork, and keep the budget balanced. Yet, in the smaller shop, one man, or a few people, probably will have all of this responsibility whilst the larger corporation has specialists for each phase. The only answer to this problem is found in knowing what to watch and where to most effectively spend each management dollar.

This report is not a cure-all, but it may ease the pain by providing systematically the elements of control; the essentials for better management of a small business. And with these principles we open the door to a much broader knowledge of the management approach to be published for you in a forthcoming series of articles which will tell you HOW TO —

- **improve production economy.**
- **have a more effective administrative staff at lower cost.**
- **make the management function more effective through managerial controls.**
- **cost and price for more consistent profit making.**
- **design an organization structure for the growing business.**
- **rotate and evaluate personnel to increase their growth potential.**
- **train and upgrade supervisors to improve personal productivity.**
- **understand small-business economics.**
- **determine the key factors affecting the day-to-day health of your business.**
- **make your company self-energizing.**

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Modern Management for the small plant

How to improve production economy...

Among the methods for reducing production costs, boosting profits, increasing effective capacity, and raising output, are:

1. Production wage incentives, which are effective if properly designed and administered, depend upon establishing fair work standards at each operation, then rewarding workers who exceed the standard output levels. While not panaceas, these plans can be vital to the economy of the shop.

Frequently, large time gaps exist between the start of these programs, their completion, and the increased profits, if any. It is possible to realize only limited gains and even to incur losses with an improperly designed wage incentive plan; a program which does not stimulate the workers sufficiently or provides bonus premiums which exceed the value of increased effort. Under the usual controls, these conditions are discovered only after long time intervals plus substantial expenditure of money. Few companies use what we term "testing incentive recovery" to insure that a plan is both paying for itself as it goes and truly producing profit. In many instances, a survey of incentive economy showed a total gain below that of the total premium earned as "extras" by production people. For example, charging maintenance of the incentive program as an added expense; with *all* gains going to production people.

Because a profusion of written material is available on this subject, emphasis will be on other techniques which abound with profit potential.

2. Methods engineering also produces savings but usually at a less dramatic rate than incentives, and also requires expenditures for permanent staffing. This is important and valuable; it should be done by all companies—but only after the companies reap the easy dollars available with smaller effort.

3. Redesign or purchase of new equipment is another way to increase production and reduce direct-labor cost. However, when the overhead expense and the rate at which the increased output absorbs the higher depreciation expenses are weighed, the cost savings may turn into a serious loss. It takes time and effort to make a cost study. Add to that expense the cost of investigation, then compare those costs with what new machines can produce. Before any decision has been made, a substantial sum of staff money has been spent.

In a sense then, steps 2 and 3 are refinements. Naturally when two competing companies produce similar products with similar equipment, and are faced with approximately the same material, labor and overhead costs, competition will occur in the area of these cost refinements unless price cutting is resorted to.

4. Proper, consistent supervisory effort can effect large savings. Supervisors can, if stimulated:

a. Reduce indirect expense required to sustain direct labor.
b. Reduce avoidable waste.
c. Improve quality and reduce returns from customers.
d. Utilize supporting labor economically.
e. Keep machine maintenance and replacement at a minimum.
f. Reduce training costs by maintaining high morale and low turnover.
g. Follow production schedules religiously.
h. Maintain good housekeeping.
i. Maintain a fair day's work pace; etc.

These elements and others, of course, comprise the job content of a complete supervisor. How many supervisors consistently devote their attention to

obtaining these savings? The typical supervisor or foreman usually has been schooled to pushing production out of the shipping door with little emphasis on maintaining, within economical limits, the above cost elements. This is production for the sake of production. In disproportion it can lead to financial inequities regardless of the attained levels of productivity.

Some plants which satisfy conditions of higher output still fail to show profit increases. There are metalworking plants which boast of high productivity yet show no appreciable improvement in profit margins. In some cases there have been reductions in profits. These companies have sound incentive plans, properly tested for premium recovery. Then where is the missing link? Why wasn't there a direct relationship between productivity and profits? Unless all cost areas are controlled collaterally with productivity increases, the full gains from such increases will not be realized. Only when all cost elements are reduced can the gains under general production incentives become realistic.

How do you control and minimize these cost elements? Is it the responsibility of the operators? Foremen? Obviously, operators should not be accountable for these expense items. Supervisors should control production economy.

Stimulating them to do so is another story. Secret of success is to evaluate and reward supervisors strictly on *those cost elements which they control;* thus provide the sharpest tool for reducing overall departmental costs. Supervisory incentives should stimulate interest in areas regarded with disinterest or outside the sphere of activity.

Establishing a supervisory incentive is relatively simple because it requires no timestudy and no involvement with labor. It is solely between the supervisors and management. Detailed plans will be described separately, but here is a brief rundown:

Supervisory incentive is based upon a number of factors. The number depends upon the areas of potential savings, the size of the company, and the supervisory job content. A small company, installing a plan on a simple basis, might select these three factors:

1. Indirect labor ratio (Allowable number of indirect labor cents for each dollar of direct labor.)
2. Machine repair ratio (Allowable number of repair cents for each payroll dollar.)
3. Waste and reject ratio (The allowable waste percentage.)

Next, assign weights to the factors. Decide the relative importance of each factor to the company's economy and the extent to which each is controllable by the supervisor. Finally, determine the standards of performance for each factor.

Apply these weights and standards to actual results to measure actual supervisory performance. Determine the supervisory bonus earned by the supervisor's ability to maintain production at an economical departmental cost or lower.

These concepts are recommended for buying something that cannot be instilled into supervisors—adequate concentration on the managing tasks which make or lose money for the company.

Easily evaluated, these incentives also aid in recruiting supervisors by giving them the feeling that they are in business for themselves; that greater achievements will bring proportionate rewards.

How to have a more effective administrative staff at lower cost...

Administration is another area for applying incentives to obtain both cost reduction and upgrading in executive personnel. Executive incentives are used with good success for people such as office managers, sales managers, and engineering heads.

In a metal-novelties company, doing approximately $5 million in annual sales volume, the office staff was out of proportion to the size of the company. By comparison with similar organizations, its office was overstaffed by 30%. The office manager, for years, had been aware of the duplication and overlap existing in the office and had purposely maintained a permanently higher staff than was necessary to protect himself in the peak periods. He was measured by management solely on keeping the office harmonious and by the absence of bottlenecks in the work flow.

Actually the man had a high potential for executive growth but had not been stimulated to use it,

as was brought out when management's thinking changed and an incentive was provided! Almost immediately, he:

1. Evaluated all jobs to provide analysis and description which served as a basis for combining functions and eliminating overlap.

2. Discarded the policy of maintaining a large permanent staff in favor of a staff size pegged to the needs of low activity periods with the use of temporary people during peak loads.

A year's experience cut the cost to less than half the previous office cost and showed annual savings of $25,000. The manager earned a bonus of about 25% of his base salary.

In most small companies, management control of operations is vested in the Profit and Loss Statement and similar reports. These are traditional accounting data which do not set out clear targets for remedial action early enough. A quarterly P & L is ancient history in metalworking because it forces superficial action after the facts instead of specific action during the facts.

A P & L statement is essential as a long range barometer of economic trends but it is inadequate for the day-to-day policing so necessary if management services are to be dynamic instead of historical. In particular, this statement smoothes out the characteristic peaks and valleys of company economy. Thus it buries profit leaks, which usually occur on a transient basis.

Many companies analyze the items in a profit and loss statement as percentages of the sales dollar. This usually shows, for example, that direct labor has changed from its level in the previous statement. If the ratio is lower it is assumed that labor utilization was more efficient; if higher, it is considered that conditions have worsened. In itself, this ratio is an isolated fact. Action should not be taken until it has been related to the other pertinent facts of the company's operation.

It is possible for the direct-labor content in the sales dollar to have risen with efficient operations and, conversely, a low direct-labor percentage is not necessarily evidence of high labor efficiency. One of the facts to which a direct labor percentage figure must be related, to be useful for managerial action, is the product mix produced during the subject period. Product mix usually has a greater effect on the direct labor content in the sales dollar than labor efficiency. If a gear company during one period has productive hours of hobbing greatly in excess of broaching hours, the direct labor percentage must be higher than that of a period in which the reverse condition obtained despite any degree of efficient operation.

Traditional profit and loss statements will not account for these product mix variations. True, some managers consider the shifting mix when they look at operating statements, but their judgments are subjective and allow no consistent comparisons of related information with previous periods. Allocation of overhead to a product is even more complicated to control and check, especially when expressed as a percentage of direct labor.

Proper managerial controls must reflect current events, relate them to the various segments of the

How costing and pricing methods

Traditional methods of product costing include a listing of direct labor and materials, with overhead assigned as a percentage of direct labor. If the overhead thus assigned does not include general, administrative, and sales expenses, these are usually allocated as a fixed percentage of production costs or of the sales dollar. This concept is, in some instances, further refined by using departmental overhead ratios to avoid distortion of a wide plant average.

This constitutes costing by product as opposed to costing by process or facility. Examine for a moment the effect of product costing in a job machine shop using a wide range of machine tools in the productive processes.

Consider two machined parts, Part A is a large plain bushing, drilled and turned on a screwmachine, and Part B is a small ground sleeve with close ID and OD tolerances. Assume for both that the direct-labor cost is the same. Applying a fixed percentage of the direct labor to both for overhead charges as-

company's economy, and provide management with a target. These controls have psychological gain even if no action is taken on the provided data. Because it is known throughout the organization that facts are being looked at, management makes its first big gain.

Areas in which the techniques of managerial controls are applied encompass every effort in the company. Some representative areas and related data are:

Information Areas:	Control Relationships:
SALES:	
Activity control; functioning under market research targets; cost of selling & prospecting; market penetration; competitive saturation; customer potential; portion of customer potential attained by dep't; sales expense.	—Sales expense vs total billing vs ostensible profit. —Ratio of sales effort to available market. —Sales activity vs item profitability.
FINANCE:	
Product profitability determinations; cash position; material purchasing; budgets; machinery needs; payroll commitments; velocity of inventory and receivables turnover; absorption rate of overhead.	—Billing per manufacturing sq ft. —Billing per gross payroll dollar. —Machine repair vs $ depreciated. —Indirect labor cents per direct labor dollar.
PRODUCTION:	
Payroll analysis; machine repair costs; waste reports.	

To dramatize the goals of managerial controls, here are some of the unrelated facts presented to one manager for a given month:

—Indirect labor ratio increased 4% over standard.
—Direct labor subsidy 1½% of total payroll.
—84 lost quotations in sales department.
—0% of new business for new products.
—Unusable waste 11%.
—Cost center activity 14% below budget.
—12 customers lost; normal period billing $86,000.
—Labor turnover 8%.
—1½% of new business for existing products.
—Customer returns for poor quality $19,000.
—Office expenses up ¼%.
—Billing $16.32 per manufacturing square foot; etc.

Further assume that the general manager or president spends most of his time away from his plant. To which matter should he direct his limited attention first? Which of the above items, irrespective of dollar value, have immediate importance and which have long range implications affecting growth? Selecting one condition at random because it may look large is too subjective to be of real value. The decision as to where managerial action should be taken results from the relation of two elements; (1) the area of greatest dollar loss consistent with (2) the margin of opportunity for reducing it. For example, a waste figure of $13,000 may be large in the company's operating figures, but if 98% of this loss is unavoidable the opportunity of saving is only $260, and so the waste factor shrinks to minor importance.

Proper control relates these diverse facts and permits sequential managerial action; it establishes criteria by which progress in control in each field is measured, and, most importantly, it integrates the costs and gains represented by all such happenings into an index or common denominator from which progress comparisons are made. Only in this way can small business, unsupported by a permanent staff of specialists, achieve managerial security.

determine consistent profit-making opportunities...

sumes that the cost of using the productive facilities is the same, which cannot be true because of the greater cost of the machines producing the sleeve.

If overhead is taken as a percentage of direct labor, it should follow that overhead is a function of, and therefore varies with, direct labor. Is this true? Considering factory overhead alone, does machine depreciation vary with direct labor? Obviously, depreciation on a machine is present at all times even if no one is working on it. How do space charges vary with direct labor? Does supervision vary with direct labor? It may, but seldom in direct ratio. The size of a supervisor's work force may increase from ten to 13 people, but that does not necessarily call for more supervisors! If he can handle the additional 3 people, then actually the supervisory loading per direct-labor hour has decreased, upsetting the fixed percentage of overhead concept. Then how do you get away from these variables—and set costs consistently and equitably?

Facility or process costing is the method proved most accurate. Accepted in wide areas of industry as the one method which recovers all costs consistently, to the point of providing the profits stated on the cost sheet, it has many collateral advantages. Some benefits are: 1. It activates cost recovery machinery whereby variances in cost absorption can be spotted immediately and remedied. 2. It points out areas of profit leaks and of maximum profitability, enabling management to key their sales efforts accordingly. 3. It provides realistic data on which to base marginal pricing policies and makes available current breakeven data. 4. In the estimating function it reduces the time consumed to cost products and (5) most importantly it assures maximum pricing security. 6. It produces accurate total cost enabling management to set and to control sales policy.

Facility costing produces what are termed machine-hour rates, or cost-center rates, wherein a product is assigned a cost based on use of manufac-

turing facilities. This method is most suitable to job shops where variety in the type and size of product is wide. For example, each operation, machine, or cost center is assigned an hourly charge comprised of all the cost elements including direct labor, indirect labor, supervision, factory, selling, and administrative expenses. Thus a multi-drill production center with one operator might carry a machine-hour rate of $13.90 while a horizontal boring mill with one operator might be $31.00 per hour. The difference accounts for and insures that the customer will pay for those greater expenses involved at the boring mill.

To further clarify this concept, it must be understood that the entire machine-hour rate less the direct-labor component would be constantly incurred even if the machines were inoperative for a short period. These are items which customers must be charged for if the company intends to recover in its sales prices all of its expenses. While there are circumstances under which a company may wish to marginally price its product, with process costing the extent of the concession, this is a matter of knowledge and not of judgment or speculation.

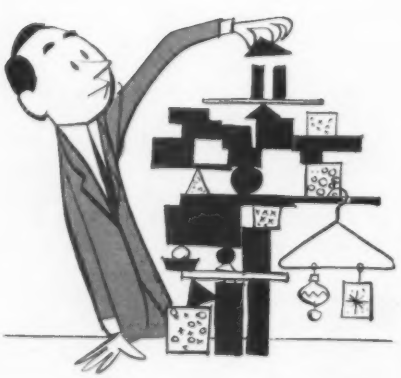
To apply this cost structure to specific products, it is necessary to have some form of time standard. If, for the multi-drill production center, the machine-hour rate is $13.90 and, for a given product to be drilled, the time per hundred is 1.4 hr, then the cost of this operation for the product would then be $13.90 times 1.4 or $18.46 per hundred. This is the same as saying that for a center which costs $13.90 to maintain, the product will utilize its facility for the benefit of the customer's order, for 1.4 hours.

This system is simple. If combined with some form of cost recovery technique it can prove the adequacy of the rates without resort to costing out each job.

The total recovery figure is compared with the period's expense schedule, which is a listing of all expenses incurred during that period including pro-rata charges for such items as rent, depreciation, and the president's salary.

If the total recovery is approximately equal to the total actual expenses, the estimates or orders have recovered the cost component of the selling price and the profit stated in the estimate is attained. If total recovery is below actual expenses, then the actual profit is lower than that stated in the estimate and this circumstance is a signal either to revise the machine-hour rates or to prune the costs. Total recovery exceeding actual expenses provides a signal to evaluate rates and sales policies lest the company be priced out of its markets. Later in this series, cost systems based on this concept will be developed for specific plants and products.

How to design organization structure for the growing business...



As a result of greater specialization and the voluminous amount of detail handled by the large corporation, lines of authority, delineation of job duties, and areas of responsibility are mandatory. The small company, however, tends to overlook the need for a well-defined organizational setup. As a consequence it suffers from growing pains each time it moves to a new economic level.

In a growth company, expansion not only changes the physical size of the organization, it changes its nature and characteristics. As companies expand their operations their need for proper assignment of duties and functions becomes increasingly important. A sound plan for accomplishing grow-ability in the smaller company is to design the organization in the early stages for rapid expansion when needed. This is termed "accordionizing" the organizational structure so *it may be expanded or contracted in accordance with current needs.* In this concept, a condensation of the ultimate organization is instituted and progressively expanded by the separation of functions at predetermined stages of growth.

Two different organizational structures for the same company will be analyzed and explained in a forthcoming article.

How to rotate and evaluate personnel to increase their growth potential...

Collateral with any organization plan or refinement is the evaluation of personnel from the standpoint of their ability to do the job assigned, or to do a job they are better suited for, with the plan of then rotating jobs and men to achieve maximum man-job compatibility. This form of rotation often results in raising an individual's ceiling in the company, if it is established that his rate of growth is better in one job than in another. Most importantly, potential abilities which may be lying dormant in his present job are discovered.

For the rank and file echelons, the production workers, personnel evaluation is usually limited to manual-dexterity testing. This is administered both to recruits and incumbents to achieve alignment between the work characteristics demanded by the production operation and the ability of the person to supply the necessary skills to fulfill them.

Many more tests are used at the supervisory or foreman levels, tests to determine degrees of intelligence, supervisory aptitude, numerical and verbal facilities, etc. However, starting with the junior-executive echelons, the test batteries expand to cover the psychological composition of the subjects, with emphasis on emotional maturity and stability, ambitions, and any other personality conflicts which may interfere with doing a job, and its acceptance by others. Whereas an individual may display marked aptitudes for certain work, he may be prevented from doing it well or communicating it to others because of temperamental limitations.

How to train and upgrade supervisors to obtain higher personal productivity...

Incentive cannot supply talent, it can only liberate available talent and put it to work. Incentive does educate people as to the effect of their efforts and the way effort affects pay and the company's position. But it cannot make up for a lack of education or experience; it can only point to it.

By an intelligent set of managerial controls, competently established, management can detect the difference between a conscientious but inexperienced foreman or executive, and one who is talented but sloppy or lazy, even though the results from both may be the same. With the former, counseling should be done by the superior, in such a way as to educate without introducing feelings of guilt or inadequacy. Both parties must understand that technical deficiencies exist and must then set about to remedy them, using managerial control data as a barometer.

Many foremen have had poor schools of experience in former jobs. Possibly the nature of the product has placed all former emphasis on delivery regardless of internal labor economy. Or, in other cases, waste was the principal item of controllable cost. To be a complete supervisor or executive calls for a well-rounded experience or education in all the facets contributing to successful operations.

Modern Management for the small plant

How to understand small business economics...

Business economics, small or large, is still an all-encompassing subject. Our chapter will deal principally with the economics of expansion for the smaller growth companies and will detail how to develop and use decision-making data. Implicit in its use is the business thinking and approach which generates the need for this data.

For instance, many companies are unaware of the danger of expanding beyond the point of maximum economy, through ignorance of the economic law of diminishing returns. The same is true in reverse. Consider the company that adds space to its present quarters based only on its immediate needs. It sometimes does not consider that the cost of breaking down an exterior end wall, and reconstructing another at the extremity of its new space area, is the same regardless of the extent of the company's physical expansion. The variables, of course, are the two side walls, the floor, and the roof. Thus, in the case of a too-small expansion, fixed costs may amount to three-quarters of the total, which in effect boosts the square-foot building cost needlessly high.

Fixed costs are amortized more quickly as the total expansion increases, hence a relationship must be established among such considerations as: the capital and tax position, the basis of realistic sales forecasts, the projected break-even point, the velocity of inventory turnover, and the speed with which productive activity recovers all overhead expenses.

Information for such decisions is usually available in some form in nearly all companies. The problem is to find a common denominator for all these details and to relate one to the other until the direction of policy emerges.

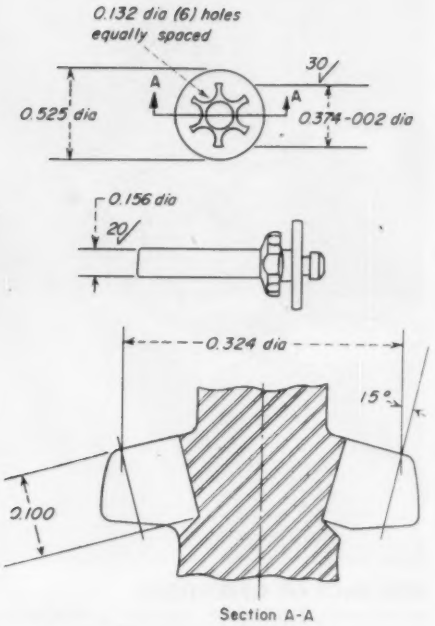
Some companies, based on impulse, emotion, or unobjective data, have expanded to meet brighter sales forecasts and failed to consider the change in their break-even zone. This change is wrought out of higher building costs, higher tooling and product development costs, greater cash risks in inventory, greater tax obligations, and other factors, making the company more sensitive to economic fluctuations. Other companies have failed to test the persistence of their present or new product market; have expanded on the overstatements of their sales managers.

There are ways to grow solidly with a minimum of risk consistent with reasonable profits and proper consideration for long range goals. Both the arithmetic and the thinking necessary to do so will be presented in future articles with emphasis on "know-how."

Do-It-Yourself

To provide Management in the smaller metalworking companies with an inexpensive set of managerial tools, which the individual manager can adapt to his own problems, American Machinist will publish, in forthcoming issues, a comprehensive series of articles describing managerial techniques for the small business. This report introduces the series.

Actually, these articles will constitute a "home-study" course—complete with quiz on each subject. They range from basic shop procedure to a simplified form of "operations research." We believe that every manager will find this information useful.



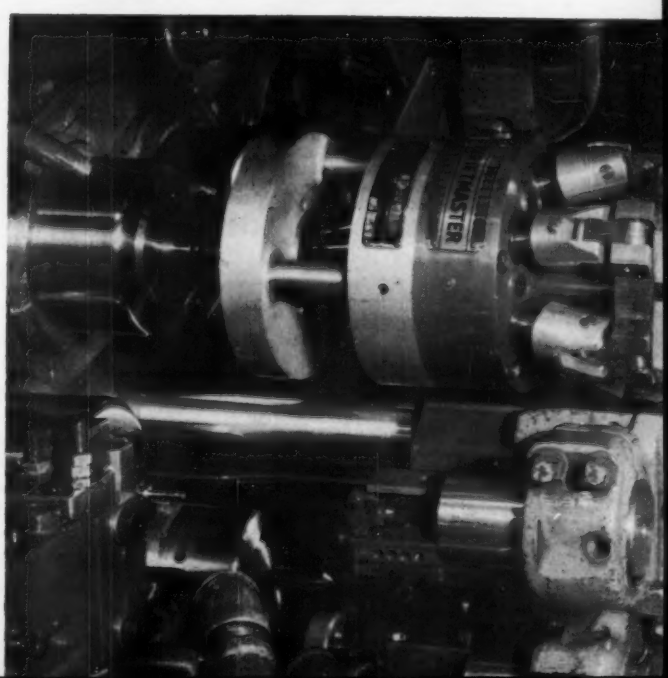
THE PROBLEM:
Valve stems (A) in a single-lever kitchen mixing faucet require six half holes on a 15° angle, equally spaced around a 0.374 ± .002-in. dia on each stem. Originally the stem was produced by cold heading, then joining a six-pronged element to it. This method failed because the prongs fatigued and fell outside of tolerance, resulting in leakage

SOLUTION:
Make the stems in one piece from 303 stainless steel, 17/32-in. dia stock on an automatic bar machine. First thought was to drill the six holes, then complete the machining. This idea failed because in subsequent machining the prongs snapped off. Trial and error showed that the piece had to be completely machined except for drilling, burnishing, and forming back end

Attachment drills multi-angular holes

Are you stymied with having to do a secondary multi-hole drilling operation because you are convinced it can't be done in the first operation? Here's a case study—on how six angular holes are drilled simultaneously in an automatic bar machine—that may cause you to change your mind

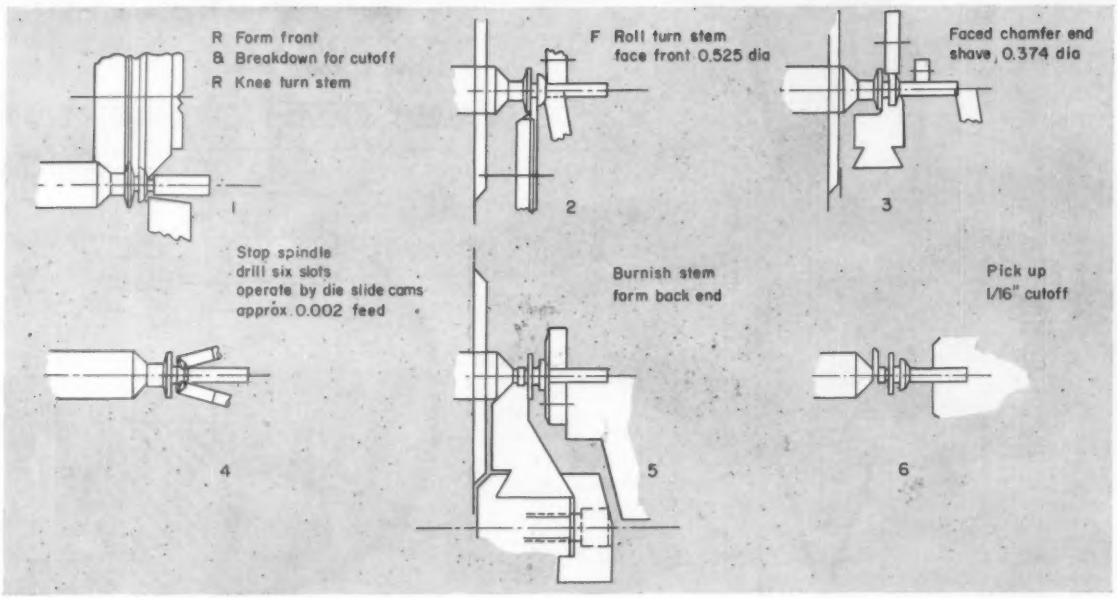
S A CAPPON,
NATIONAL SCREW MACHINE PRODUCTS,
CLEVELAND, OHIO



SIX-SPINDLE DRILLHEAD ATTACHMENT . . . equipped with standard drills ground flat machines semi-circular holes in alignment at a 15° angle. End mills had been tried but proved too expensive. A quick stop mounted on the machine controls the one spindle for the drilling operation

PLEASE TURN PAGE

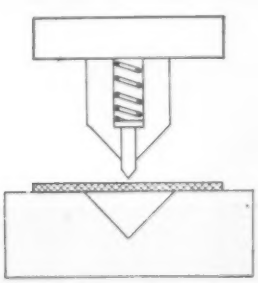
Attachment drills multi-angular holes . . .



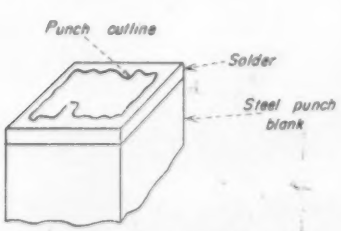
SEQUENCE OF OPERATIONS . . .
on automatic bar machine shows the drilling operation in fourth position and burnishing stem to 20 mu. in. rms in fifth position. The 30 mu. in. rms finish on the 0.525-in. dia is produced by shaving and eventual tumbling. Production rate is 12 sec per piece

Diemakers Kinks

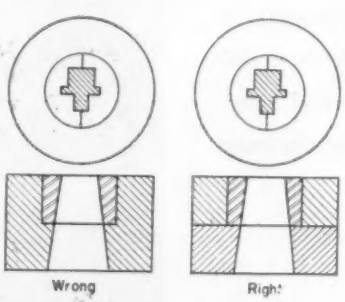
FEDERICO STRASSER



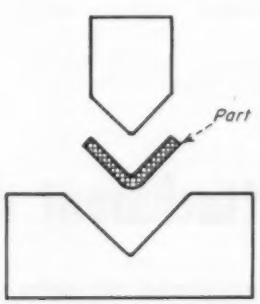
A SPRING-BACKED prick punch, fitted into a bending punch, will engage a blank and hold it against slipping until actual forming begins.



TO COPY a complicated die opening on a punch blank, give the latter a flash coat of copper and lay on solder about 1/16 in. thick. Press the punch blank onto the die so that the solder between mating surfaces is squeezed, leaving an outline of the die opening. Now machine the punch to the outline and finish the punch in the customary manner.

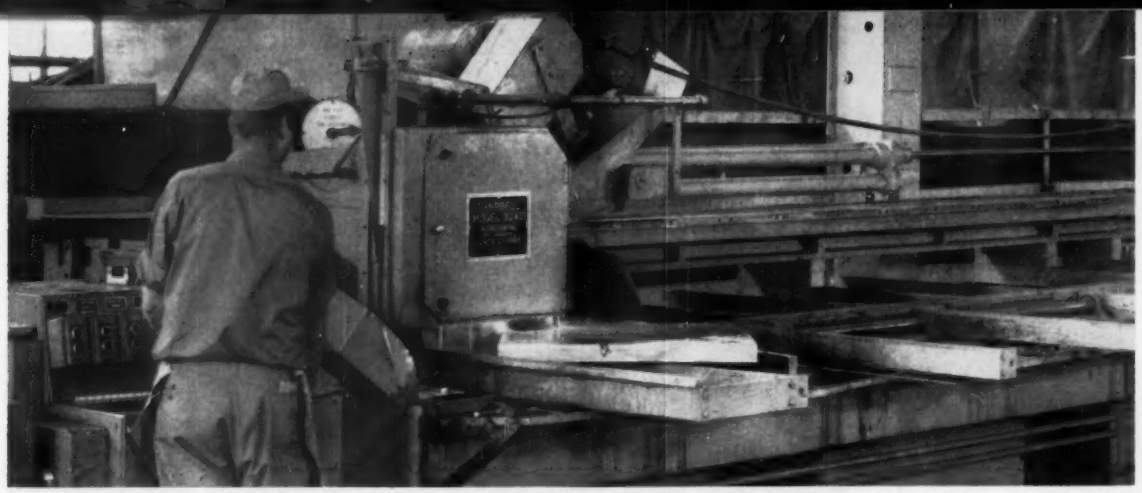


SECTIONAL die parts are preferably held or encased in a ring rather than being fitted into a counterbored hole, because it is likely that there will be less chance of spreading or opening at the top. The case is then screwed and doweled to a supporting ring below.



WHEN STORING forming tools, keep a sample part with the die in order to save time for identification and setup when the next production run is to be made. This suggestion also applies to other dies not mounted in a dieset.

WHEN CLEARANCE holes in the bolster or press table are too small to pass the blanks or slugs, mount the die on parallels as at *A* or machine transverse channels in the die shoe as at *B*. In both cases, the blanks or slugs must be removed from the tool periodically.



"Hastelloy X" plate 2¼-in. . . . thick is being trimmed at the corners, after cutting from a larger piece, so that a 33-in. circle can be machined on a lathe. On 1-in. plate, the 39,000-lb machine has doubled production. On 2½-in. plate, productivity has been increased five-fold

Heavy-plate fabrication aided by abrasive cutting

CURT CUMMINGS, product manager, Campbell Machine Div, AMERICAN CHAIN & CABLE CO, INC, BRIDGEPORT

"Hastelloy" plate up to 3 in. thick by 72 in. wide by 15 ft long is being cut rapidly into wanted shapes to an accuracy of ± 1/32 in.

Milling and edge grinding of pieces cut from heavy plate are time-consuming and expensive secondary operations. If these operations can be virtually eliminated and the cutting-off operation itself is fast, the fabricator can make handsome savings.

A generation ago, abrasive cutting off was limited to rounds and light sections, but today the machine and wheel makers can cope with heavy-duty operations such as one finds in plate shops. In fact, the abrasive cutting process has been improved to such an extent that it is the only way to cut some hard materials, let alone being the most economical method of cutting most of them.

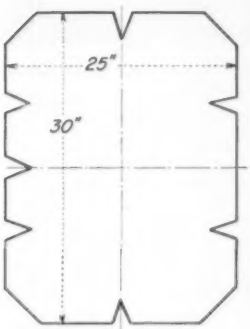
Several months ago Haynes Stellite Company's Wrought Alloy Plant at Kokomo, Ind, installed one of these large cutting-off machines. That company estimated originally that the unit would pay for itself in seven years, based on a 40-hr week. Actually, the equipment will amortize itself much sooner, because work has been found for the machine around the clock, seven days a week. Rectangular or irregular pieces can be cut off rapidly in a single pass. Examples: a ¾ x 15 3/16-in. pc of Hastelloy C in 1 min, 52 sec; a 1 x 54 3/16-in. pc of Hastelloy B in 6 min, 2 sec. For this work an Allison DA46-Q-RH4 wheel of 18 3/32 in. dia by 0.135 in. thickness was used.

To perform high-speed, burr-free abrasive cutting of hard materials, the plate fabricator should observe certain suggestions:

1. Select a machine to suit the particular work, because no one type will perform effectively on all types of cutting operations.
2. Pay attention to design of the workholders, how coolant is applied, the type of controls and the general arrangement of the machine for convenience of the operator.
3. Keep test samples on hand for comparison purposes, make periodic checks of machine adjustment and wheel suitability, to avoid inferior cuts.

If the machine is suitable for the work and in good condition, and the wheel is the proper one for the job, a rule of thumb in respect to costs is: 6 sec cutting time per square inch of material in rounds up to sizes containing 3 sq in., at a wheel cost of $0.004 to $0.006 per sq in. Larger cross-sections will require slightly longer cutting time.

In the case of the Campbell No. 3420 machine installed at Kokomo, plate up to 3 in. thick is cut at a rate of 4 to 6 sq in. per min. This machine will take pieces up to 20 ft long by 72 in. wide and will cut across the 72 in. width at any location on the plate. Overall length of the machine is 38 ft, the width 9 ft, and table height is 38 in. Power for the main drive is supplied by a 25-hp motor, the hydraulic system uses a 3-hp motor and the coolant pump a ¼-hp motor. Weight of the machine is 39,000 lb. Controls are centralized at the left side of the machine. From this station the operator can control all motors and wheel adjustments. Feed rate for the 20-in. wheel is up to 20 ipm. These statistics and specifications give an idea of the size and power of current-model abrasive cut-off machines for heavy plate. Still larger and more powerful machines are on the drawing board.



Cycle time is one minute for drawing magnesium modulator cover complete with stiffening ribs. Meehanite die has high wear resistance that is considerably aided by colloidal-graphite lubricant picked up from blank. Irregular number of notches on blank is to relieve metal according to the different numbers of ribs on box sides

Magnesium is drawn...and ribbed

...in one shot
...with uniform metal thickness
...and without wrinkles

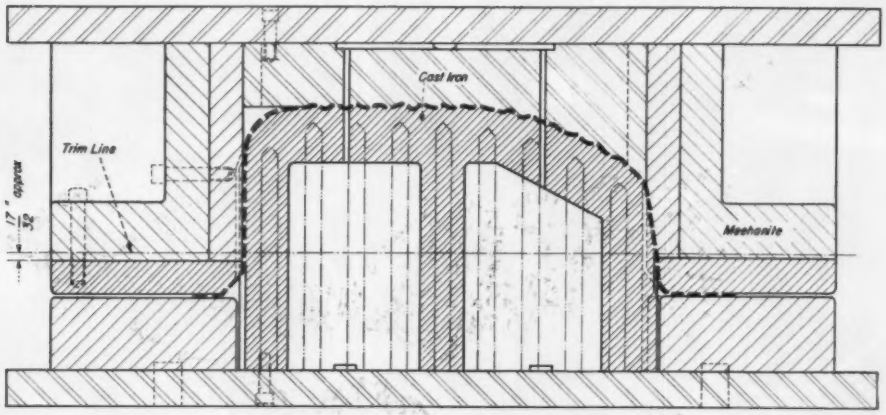
GEORGE H De GROAT
Detroit editor

This job involves the most extreme movement of metal ever run at Brooks and Perkins, Inc, Detroit. It is handled in short runs of 100, 200, and 300 at a time, and includes a medium draw of 8 in. for 0.091-in. stock and an embossing action that produces stiffener ribs as integral parts of the rectangular box-shape part.

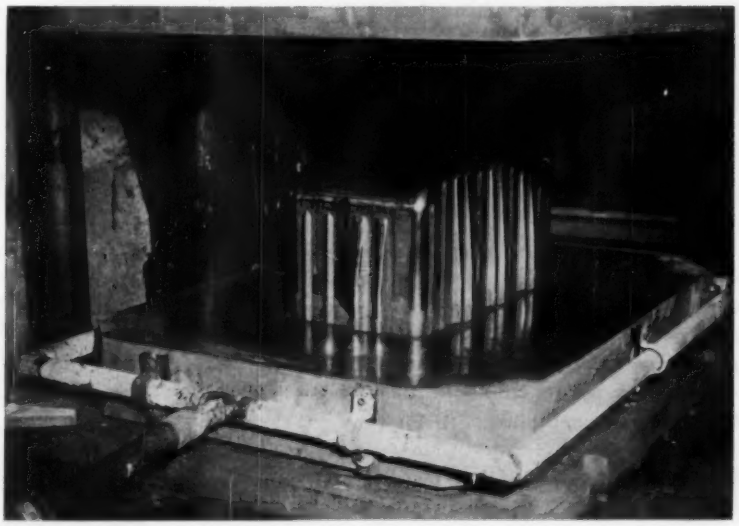
The draw is made in a 200-ton hydraulic press with one stroke in a single die, ending up with a shape 8 in. high, 8 in. wide, and 18½ in. long. The blank of ASTM alloy AZ31-B is 25x30 in., and has bevelled corners and notched sides and ends that relieve the metal and prevent buildup during the draw. This eliminates binding and wrinkling and permits an even flow of metal so the drawn part has uniform thickness equal to the gage of the blank at the start.

Blanks are preheated to 600-650 F in an oven before drawing in the Meehanite die. The tools are also heated by a gas-fired platen that maintains 650 F at the pressure ring and die, while the punch temperature is not permitted to drop below 575 F. The drawing lubricant is heat-resistant colloidal graphite sprayed on the blank before draw is made.

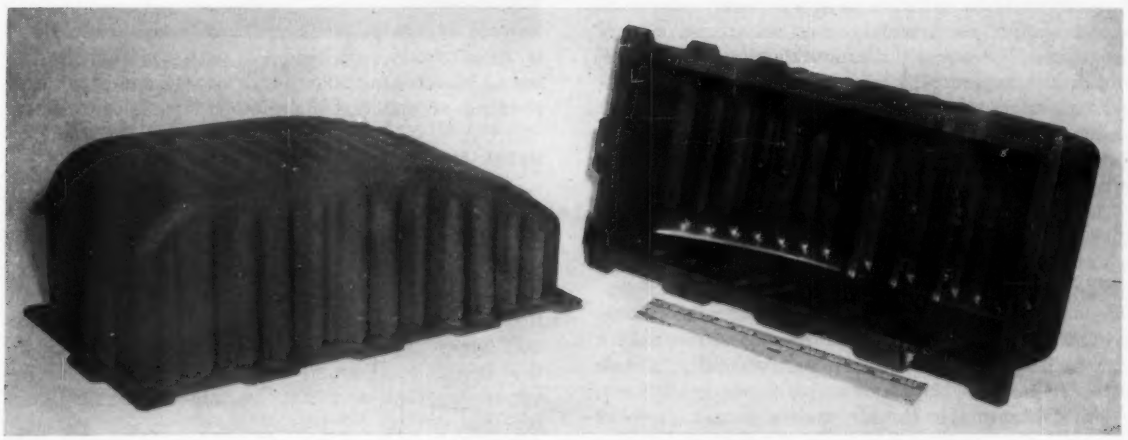
In this setup, the die is in the upper ram and the punch is stationary. The blank is held between pressure rings and pulled in and drawn down over the punch. Uniform press speed and evenly applied pressure produce consistently good results on the modulator cover.



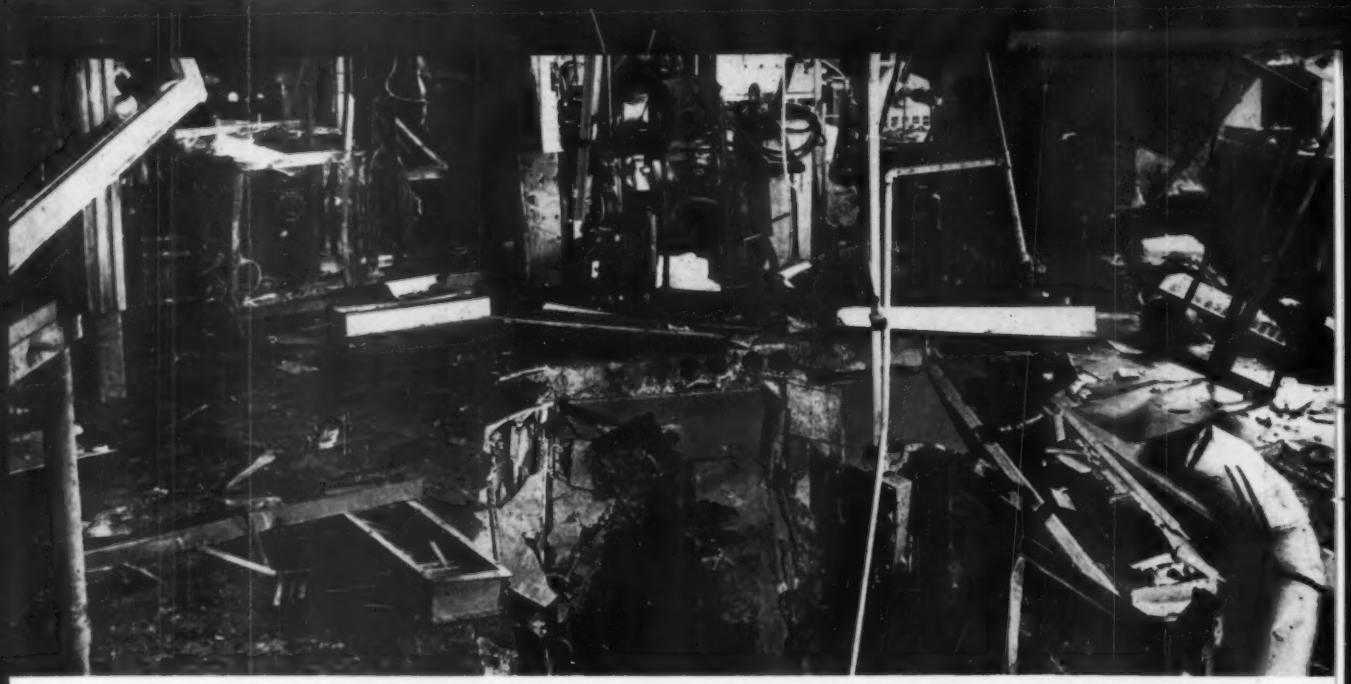
Tool construction is rugged, but simple, for drawing covers in one stroke. Punch design includes 1/32-in. clearance spaces in 12 locations below trim line at the vertical portions of the large beads. In addition, six 13/64-in. radii are provided between the large beads. Stock does not spring back, and no intermediate anneals are required



Inverted draw die is gas-heated to 650 F, which eliminates rapid work-hardening in the magnesium, but does not affect room-temperature properties of the part. All dimensions of die and cast-iron punch were multiplied by 1.004 to allow for differences in coefficient of thermal expansion between punch, die, and sheet



Finished cover has cast AZ91-C base welded to bottom. Drawn blanks were trimmed with routing fixture, then graphite was removed by chromic-acid dip. After base was welded on, mounting holes were drilled and countersunk, and sealing surface ground flat. Additional stiffeners and bosses were welded inside cover to support equipment added later



Thorium explosion in July, 1956 . . .
Hole in floor was former location of a covered pail containing 30 to 40 lb of scrap. A golf-ball-size piece of the material exploded while being burned in a special hood, and the second blast, involving the whole pail, followed almost immediately

THE MYSTERY OF PYROPHORICITY . . .

Metals that burst into flame

AEC has started a crash program to find out what causes metals such as zirconium, hafnium, and titanium to display, on occasion, abnormally increased fire properties. Here is a summary of the problem: what we know and don't know and what you can do to avoid fire when working the pyrophoric metals

RICHARD B SMITH, Safety and Fire Protection Branch,
U S ATOMIC ENERGY COMMISSION, WASHINGTON, D C

Pyrophoricity is, unfortunately, a property of several of the metals most widely used in atomic energy programs. Plutonium, uranium, thorium, zirconium, and hafnium are afflicted, as are titanium, magnesium, calcium, sodium, and potassium. Yet our understanding of pyrophoricity is very meager, quite inadequate to cope with the broad range of behavior exhibited by pyrophoric metals.

Although pyrophoric metal fires are infrequent, the cumulative experience in handling large quantities of these metals includes thousands of incidents. The vast bulk of these were minor spontaneous fires involving no property damage. However, a number were unusual incidents, the causes of which are difficult to explain rationally; a few involved fatal injuries and major property damage.

Unlike flammable liquids, metals do not ignite at consistent temperatures when heated in air. Metallic uranium, for example, can ignite spontaneously in air at room temperature when in the form of fine powders, but massive metal (solid chunks) will not normally ignite even when heated to its melting point. Yet a case is known where a yeast-cake-size piece of massive uranium ignited spontaneously while resting on dry ice.

In another case a uranium specimen at room temperature spontaneously exploded. Spontaneous uranium fires have occurred under vacuum, under water, and under argon atmospheres.

Nevertheless, in many respects, spontaneous ignition of metal powders is similar to spontaneous ignition of oily rags, whereas self-sustaining burning of massive metal is more nearly comparable to burning of ordinary flammable liquids and solids.

This article is condensed from "Pyrophoricity—a Technical Mystery Under Vigorous Attack," which appeared in Nucleonics, *Dec, 1956.*

METAL FIRES V LIQUID FIRES

At the risk of oversimplification, a further comparison with flammable-liquid combustion is helpful in obtaining a better understanding of observed vagaries in metal fire and explosion properties.

Flammable vapor-air mixtures burn only when the concentration of vapor is between the lower and upper explosive limits. It is important to note that actual combustion involves an air-flammable-vapor reaction and not an air-flammable-liquid reaction.

When a small amount of flammable liquid is burned, the heat of combustion raises the temperature of the liquid to its boiling point where it re-

Separating walls . . .
did not prevent the spread of fire, once it got started in this zirconium scrap storage area, after a heavy rain. Following the initial blaze, flare-ups occurred in several non-adjoining bins, as well as spreading from bin to bin

Flare-up of zirconium scrap . . .
during disposal operation in May, 1956. After two men had been killed and a third lost an arm while attempting to re-crate scrap zirconium for removal, it was decided to burn the remaining scrap cautiously in an outdoor storage area

mains constant until all of the liquid has vaporized. Experiments indicate that free burning of metals in air takes place at temperatures well above the metal melting point, at which temperatures the metal vapor pressure is well within a range comparable to that of flammable liquids undergoing combustion.

In the case of massive pyrophoric metals, the surface is rapidly cooled by conduction of heat to subsurface levels at a rate far greater than can take place between quiescent layers of liquid. This ability to dissipate heat accounts in large measure for the difficulty in obtaining and sustaining combustion of such specimens without continued external application of heat. In view of the extremely high temperatures required for massive metal combustion, plus the fact that heat-radiation losses take place at a rate proportional to the fourth power of the temperature, the rarity of massive-metal fires is not surprising.

POWDER COMBUSTION

The large difference in observed pyrophoricity of metal powders and massive metal proceeds from differences in secondary factors influencing combustion efficiency, rather than from any basic difference in the reaction mechanisms involved.

Metal powders possess a much greater surface area on which to generate heat, have a much smaller mass of metal in which to dissipate this heat, and have a much smaller percentage of total surface area available for loss of heat by radiation to external surroundings. All of these factors combine to increase the probability of metal combustion.

Unlike solid metal (in which heat can be internally transferred by the relatively efficient process of direct heat conduction), escape of any heat from within metal powders must largely take place by radiation through multiple insulating layers of air. Thus, accumulation of heat generated with metal powders by slow oxidation becomes increasingly probable with increasing size of powder mass and with decreasing particle size.

Several interesting observations have been made of the effect of powder mass on pyrophoricity. One example is that dust obtained by filing a zirconium-titanium alloy never ignited when dispersed over a bench, but always ignited spontaneously whenever small layers were accumulated.

WHAT CAUSES PYROPHORICITY

The study of many unusual pyrophoric-metal incidents indicates that several independent mechanisms may contribute to metal pyrophoricity, and that surface oxides, stress, moisture, and contaminants are major facets deserving evaluation.

Oxygen—Although pyrophoric metals burn in oxygen, the pyrophoricity of many metals, such as uranium, can often be dramatically reduced using oxygen. The ability of oxide coatings to reduce apparent metal pyrophoricity varies considerably among different metals and even among specimens of the same metal. However, one commercial process is now being used to reduce the pyrophoricity of highly porous titanium and zirconium sponge produced by the Kroll process.

Moisture exerts a strong influence on metal pyrophoricity. Metals such as sodium and potassium can react violently with water, as is well known. In the case of uranium, the high-temperature reaction with steam is much more violent than with oxygen. A few violent water-metal explosions have accidentally occurred in industry (notably during arc melt-

ing of titanium in water-cooled crucibles). However, the rarity of such accidents suggests that explosions of this type are only attainable under a very narrow set of conditions.

Stress—There exists fragmentary but impressive evidence that pyrophoricity is increased when the metal is under stress. This stress can be physical or chemical. Uranium lathe chips, for example, appear to be very much more susceptible to spontaneous ignition than annealed metal of the same dimensions in sheet form. Several incidents suggest a connection between stress and metal-surface explosions in nitric acid. Sudden release of elastic strain can, under suitable conditions, cause adiabatic heating of metallic titanium fragments to their ignition temperature in air.

Contaminants—Sodium-potassium and titanium-zirconium alloys are more pyrophoric and have lower melting points than the pure constituent metals. This suggests that metal contaminants which lower melting points can, in some cases, add to metal pyrophoricity.

Hydrogen—The metal fire and explosion vagaries studied covered a wide range of temperatures, metal purities, atmospheres, surface-to-mass ratios, etc. The only factor that appeared to be commonly involved in all of these incidents was hydrogen. All of the metals involved had either been made by hydride decomposition (and could therefore be suspected of retaining some hydrogen) or had at some time been exposed to water in some form.

The evidence of the significance of hydrogen was often dramatic. Thus, uranium chips often ignited in moist air but seemed nonpyrophoric in dry air. Metal spontaneously ignited (sometimes even in the absence of air) after prolonged storage under moist argon or water.

While it is known that hydrogen on and below the metal surface is not the sole cause of pyrophoric anomalies, it is reasonably certain that it is a major contributing cause. It is thought that the principal effects include increasing internal stress, reducing surface-oxide protection of the metal, and promoting metal surface fragmentation (in part through effects on brittleness, accentuation of grain boundary defects, and subsurface gas evolution under heat).

THE MYSTERY OF PYROPHORICITY . . .

Handling Uranium

Manufacturing experience with this pyrophoric metal suggests proper handling methods for others in the same family

1. Massive uranium is normally incapable of self-sustaining combustion in air without the continued application of heat from external sources. The occurrence of fires during rolling, extrusion, forging, storage, etc, is exceedingly rare even when manufacturing uranium strip.

2. The frequency of fires that may be expected while metallic uranium is being sawed or while lathe or milling operations are being performed will vary with the type and rate of coolant application.

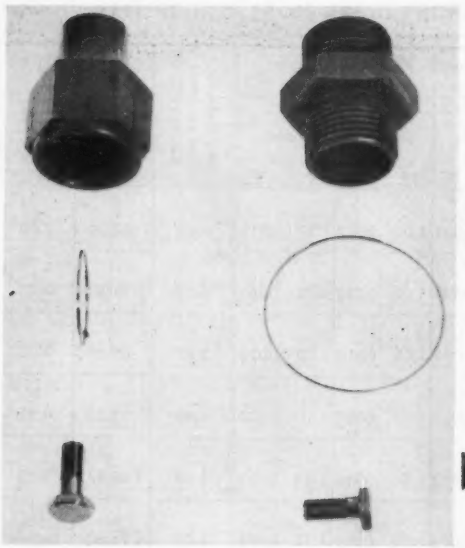
a. If no coolant is used, the chips or sawdust will often spontaneously ignite in air at the time of their creation.

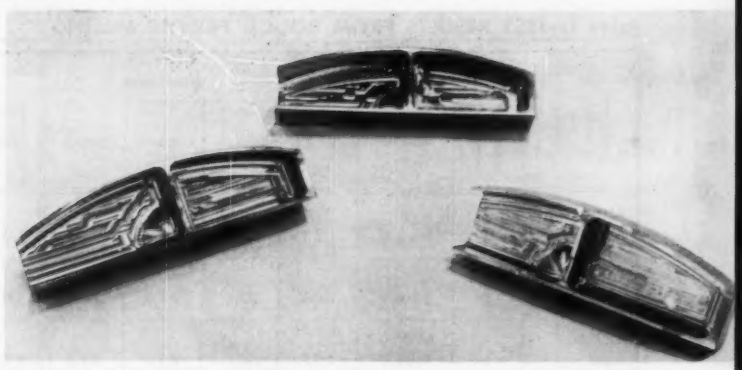
b. If mineral oil coolants are liberally applied during machining operations, few if any spontaneous fires may be expected to occur in the chips.

c. If water (or a water-soluble vegetable oil) is copiously applied as coolant, sporadic minor fires may be expected in the metal chips or sawdust at the time of their creation. Such a fire in a single lathe chip normally burns itself out after a few seconds duration but may on occasion spread to other chips in the immediate area. When this occurs in a small amount of lathe turnings, the fire may generally be easily extinguished by "dousing" with coolant. A fire involving a large amount of chips on a lathe bed may be difficult or impossible to extinguish. While uranium chips, turnings, and sawdust do not normally spontaneously ignite during subsequent handling in air, literally thousands of spontaneous fires of this type have been suffered. Extinguishment or control of such fires is difficult or impossible where large accumulations of chips or turnings are involved. Controlled incineration or digestion by chemical means afford the safest methods for averting fire hazards from uranium chips and turnings. Where this is not possible, care should be taken to keep accumulations of metal chips at any one point to a minimum. The hazards of spontaneous ignition may be minimized by storage of chips under mineral oil although under these conditions gaseous hydrogen will be very slowly evolved. When chips are stored under water (or water-soluble coolants), hydrogen evolution takes place somewhat more rapidly.

3. Finely divided metal powders created by any means are particularly pyrophoric. Grinder sludge, for example, may spontaneously ignite while immersed in water for periods of a day or more. Dry uranium powder normally ignites spontaneously when exposed to air. If the metal powder is dispersed in air, explosions may be expected.

**From* The Fire Properties of Metallic Uranium *by R B Smith. Published by Technical Information Service, Atomic Energy Commission. Available from the Office of Technical Services, Department of Commerce, Washington 25, DC. 11 pages. Price 20¢.*





Profile-milling tests were run on a Keller to produce this complex shape. These are typical parts of RS140X titanium after rough machining (Table I)

Typical turning-test specimens of 6A1-4V titanium include complex shapes. They showed lower coefficient of friction and easier cutting characteristics than steel, gave good finish as long as tools were kept sharp. Machine-requirement ratio was 3:1 over aluminum and steel for the same job

Consider ALL variables, and . . . superalloys will NOT hurt production rates

Last August, we published an extract of a report indicating that superalloys created machining problems that might set shop practice back 25 years. Based on their experience with 6A1-4V titanium alloy and others, two engineers at Boeing take issue with that report. Here is their "case for 6A1-4V titanium"

MARTIN L SCHUEHLE, manager, Research & Development Section, and
H L BARLOW, chief, Tool Engineering, BOEING AIRPLANE COMPANY, SEATTLE

Recent comment on the machinability of thermal-resistant materials has been pessimistic: "Few of the machine tools now used in the aircraft industry can be converted economically to the machining of heat-resistant materials". . . . The effect of conversion would be "a 25-year setback in production". . . . Both quotations are from "Will superalloys set production rates back 25 years?" (*AM*—Aug 13 '56, p117).

But these conclusions are based on time-series data. Any mathematician of the Middle Ages attempting to predict the Industrial Revolution on a basis of time-series data would have missed by 1000 years. Production rates of the early Thirties could never have been extrapolated to predict wartime production rates of the Forties. How, then, could any estimate of future rates for heat-resistant materials be seriously considered on that basis?

Let us, for example, consider as typical the developments in working titanium. Basing their investigation on the whole range of manufacturing variables, engineers at Boeing Airplane Company have shown conclusively that 6A1-4V titanium alloy can be adapted to airframe fabrication on existing tools and with existing procedures, needing only slight modification to achieve an ease and rapidity that belies previous estimates. Research has concentrated on integrating titanium alloys into manufacturing methods with machines as much like those for aluminum as possible. Findings are optimistic.

Research in the adaptability of titanium to airframe fabrication is not of particularly recent vintage. In the late Forties, the military services, in cooperation with industry and university production-research engineers, published basic research data on machining high-strength metals which could be readily used in specific production applications.

The result has been that today in some airframe-machining operations, such as turning, 40% of the materials being worked are, on the average, in the range of 150,000 to 180,000 psi. When it is remembered that by 1965 about 70% of the metal poundage in airframes will be thermal-resistant materials, the importance of continuing research is obvious.

The importance of concentrating research on ti-

Superalloys will not hurt production rates . . .

table 1..TEST RESULTS FROM ROUGH PROFILE MILLING

Material	Number of Specimens	Cutter Material	Avg Cutter Dia, in.	Speeds, sfpm			Feeds						Avg Machining Time per Specimen, hours *	Metal Removal Rate, cu in. per hour **	Average Cutter Life, hours
				Estimate	Carboloy Computer	Actual	Estimate		Carboloy Computer		Actual				
							ipm	ipt	ipm	ipt	ipm	ipt			
SAE 4340	3	M-3 Type 2	1.53	100.0	118.0	87.5	2.00	.0021	2.00	.0017	1.27	.0016	4.09	52.00	3.50
AM 350 Steel	3	18-4-1	2.00	23.0	23.0	15.2	1.00	.0053	1.00	.0053	0.71	.0061	6.75	31.59	0.27
422 M Steel	3	M-3 Type 2	1.27	60.0	85.0	32.5	1.00	.0014	1.00	.0010	1.02	.0026	3.47	62.20	4.00
RS-140 Ti	3	18-4-1	1.76	42.0	44.0	32.1	1.00	.0025	1.00	.0025	1.10	.0040	4.99	39.68	0.21
6AL-4V Ti	3	M-3 Type 2	1.71	92.0	80.0	33.5	1.00	.0013	1.00	.0015	1.33	.0045	2.80	66.47	2.00
2014-T6 Al	1	18-4-1	1.00	280.0	300.0	165.0	1.00	.0005	1.00	.0005	1.58	.0006	2.07	94.60	No Failure
7075-T6 Al	1	18-4-1	1.00	280.0	300.0	165.0	1.00	.0005	1.00	.0005	1.50	.0006	1.27	154.20	No Failure

* *Includes time required for cutter changes* ** *Includes prorated time for cutter changes*

tanium is apparently less obvious. But consider that titanium is the ninth most common element in the earth's crust, fourth among engineering metals. It is 60% as heavy as alloyed steel; its tensile strength approaches the tensile strength of most alloy steels. Titanium is also resistant to corrosion by air, salt water, nitric acid, wet chlorine, and organic as well as inorganic chlorine solutions. In comparison to the corrosion resistance of light-metal alloys, this constitutes a decided advantage in airframes.

Even more pertinent is the fact that some titanium alloys have been proved capable of maintaining high strength in excess of 700F over long periods.

Granted these advantages, why is the industry hesitant about accepting them? Recently publicized opinion would have it that "hard" materials set back production rates 25 years. Yet Boeing's experience contradicts this. Consider 6A1-4V titanium:

In applying titanium alloys to production processes and equipment, all facets of the manufacturing variables had to be evaluated. This meant evaluating types of machines already in existence, machine utilization, speeds, feeds, chip load, existing tooling, and operator familiarity. To have used only one of these variables to predict results would have presented a completely distorted picture.

As with all applied-research efforts, the proof is still the actual application of learned technology to actual production conditions. The experience with 6A1-4V titanium may be illustrated by the tests conducted of profile milling and turning:

Machine requirements for profile milling the alloy were determined by a test that involved a comparative evaluation of machine requirements for SAE 4340 steel, AM 350 steel, 422 M steel, and 6A1-4V titanium, using 2024-T6 and 7075-T6 aluminum as base criteria. An A22B-G Keller was used with the same tooling for all specimens. The same specimen configuration was used for all testing (sketches). Multiple specimens were tested to yield these statistically significant results:

The titanium alloy, in both the annealed and heat-treated conditions, required 1.5 more profile-milling machines than did 7075-T6 aluminum. This ratio was less than that for any of the steels tested; 4340 steel, for example, in both annealed and heat-treated conditions, required a machine ratio of 1.9:1 over aluminum. Only a year ago, industry reports were quoting a ratio of 5:1 for titanium.

Cutter life for profile milling 6A1-4V titanium in heat-treated and annealed conditions averaged 1.4 hr, compared to 3.75 for 7075-T6 aluminum alloy or 2.25 for 4340 (236,000-psi) steel. Cutters used during the tests were of the best recommended and developed geometry and material selection, needing only closer-than-ordinary control of cutter grinding and heat-treating practices for successful operation. The necessity for closer control emphasized again what industry has been rapidly learning; that the tool-grinding room should be considered a production shop, with specified drawing tolerances on cutter geometry and with specifications closely followed on the heat-treating of the cutter for proper relationship of shank-to-flute hardness.

Profile-milling tests thus indicated more than just the machine requirements for milling 6A1-4V titanium. Results also teach that better tool-grinding practices and control can be effected by thinking in terms of the quality of the tool ground and by applying the well-known practices of statistical qual-

table II..TEST RESULTS FROM FINISH PROFILE MILLING

Material	Number of Specimens	Cutter Material	Avg Cutter Dia, in.	Speeds, sfpm			Feeds						Avg Machining Time per Specimen, hours *	Metal Removal Rate, cu in. per hour **	Average Cutter Life, hours
				Estimate	Carboloy Computer	Actual	Estimate		Carboloy Computer		Actual				
							ipm	ipt	ipm	ipt	ipm	ipt			
SAE 4340	3	M-3 Type 2	1.38	40.0	38.0	14.3	.75	.0014	.75	.0050	.59	.0037	6.03	4.77	1.00
AM 350 Steel	3	M-3 Type 2	1.74	22.5	25.0	13.6	.75	.0037	.75	.0025	.75	.0064	8.66	3.21	0.61
422 M Steel	3	2A5	2.00	40.0	38.0	32.3	.50	.0017	.63	.0022	.75	.0030	5.70	4.07	0.15
RS-140 Ti	3	M-3 Type 2	1.19	10.0	15.0	9.4	.50	.0042	.50	.0027	.50	.0042	5.62	4.14	0.46
6AL-4V Ti	3	M-3 Type 2	1.04	30.0	35.0	22.5	.50	.0012	.75	.0015	.75	.0023	4.34	7.17	1.00
2014-T6 AL†	1	18-4-1	0.88	280.0	300.0	165.0	1.00	.0005	1.00	.0005	1.58	.0006	3.18	9.84	3.50
7075-T6 AL†	1	18-4-1	0.88	280.0	300.0	165.0	1.00	.0005	1.00	.0005	1.50	.0005	2.75	11.01	4.00

** Includes time required for cutter changes*
*** Includes prorated time required for cutter changes*
† Roughing and finishing performed in one setup

table III..PROFILE-MILLING METAL-REMOVAL RATES

Material	ROUGHING		FINISHING		AVERAGE		
	Cutting Hr	Cu In./Cutting Hr	Cutting Hr	Cu In./Cutting Hr	Cutting Hr	Cu In./Cutting Hr	
2014-T6	2.07	94.60	3.18	9.84	5.25	47.15	
7075-T6	1.27	154.20	2.75	11.01	4.02	59.75	
4340							
S-1	5.64	35.42	7.18	4.18	12.81	17.92	
S-2	3.37	59.01	5.02	6.69	8.39	27.70	Note 1
S-3	3.26	61.59	6.88	3.34	10.22	21.87	
AM-350							
S-1	7.53	25.78	8.82	3.07	16.34	13.53	
S-2	8.50	22.84	9.73	2.94	18.23	12.22	
S-3	4.24	46.15	7.45	3.64	11.69	19.07	Note 2
6AL-4V Ti							
S-1	2.40	70.28	2.60	9.00	5.01	38.39	Note 3
S-2	3.45	54.36	3.00	8.32	6.45	32.93	
S-3	2.57	74.78	7.42	4.21	9.99	2.37	
RS-140 Ti							
S-1	6.43	26.25	6.30	2.92	12.73	14.70	
S-2	4.56	43.73	6.13	4.40	10.69	21.18	Note 4
S-3	4.00	49.07	4.45	5.10	8.45	25.93	

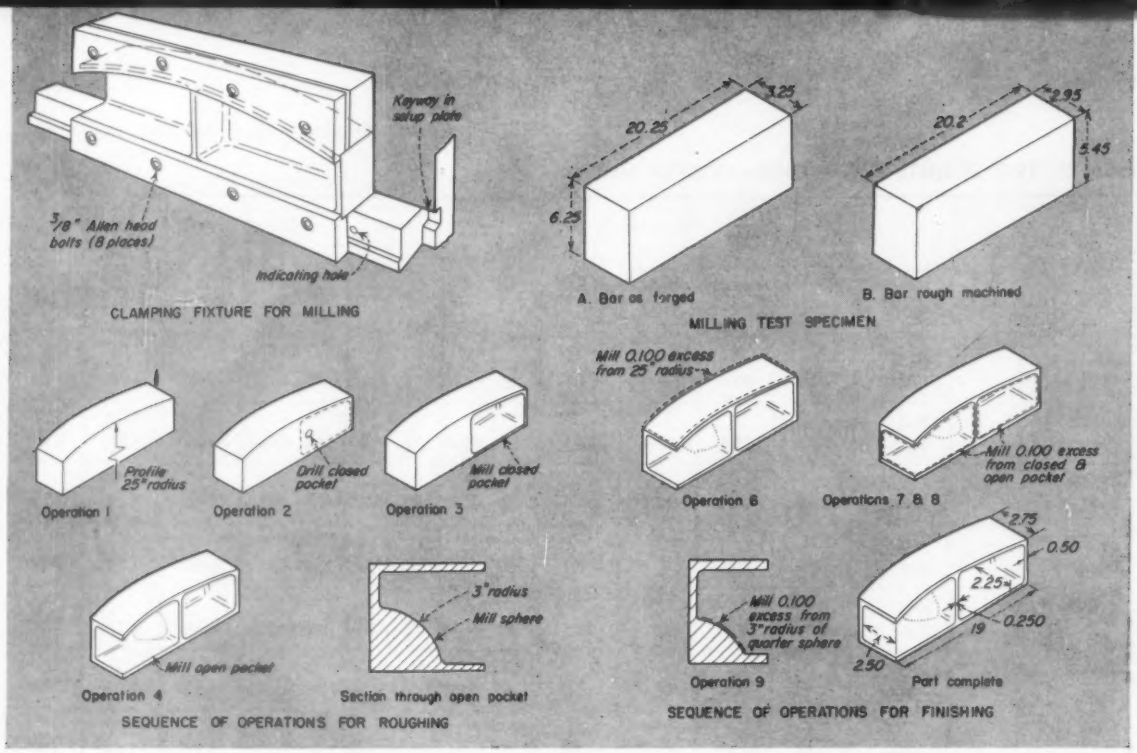
S-1 Of both titanium specimens undersize because of Test Specimen Removal
#1 Average of all three specimens used for equipment requirements
#2 Specimen #3 was used for equipment requirements because this specimen was machined after cutter development had been completed
#3 High values used for equipment requirements—specimens followed cutter development
#4 High values averaged for equipment requirements—specimens followed cutter development

Why Estimates and Actual Rates Differ

Reasons for the difference between feed and speed values obtained from available literature and the Carboloy computer on one hand, and those found practical on existing profile-milling equipment on the other, are:

1. Insufficient rigidity of columns on the test machine tool—a frequent problem in profile milling.

2. Reproductions at the spindle of induced tracer vibrations, which made impossible the accurate reproduction of templet contour at speeds recommended in literature. This condition was also responsible for early cutter breakage at higher speeds and feeds. A rigid machine, unaffected in performance by the dynamic characteristics of a tracer system, will make possible speeds and feeds more nearly approaching those recommended by current literature.



Details of the profiling test include the fixture, the piece, and the sequences for roughing and finishing

ity control to toolroom philosophy. The use of quality-control charts, quality levels, and periodic sampling for the life of tools in use in production has been found to pay large dividends. As a matter of fact, the undue concern over the problem of tool-grinding costs for titanium-machining operations is based on a disregard of this simple control principle.

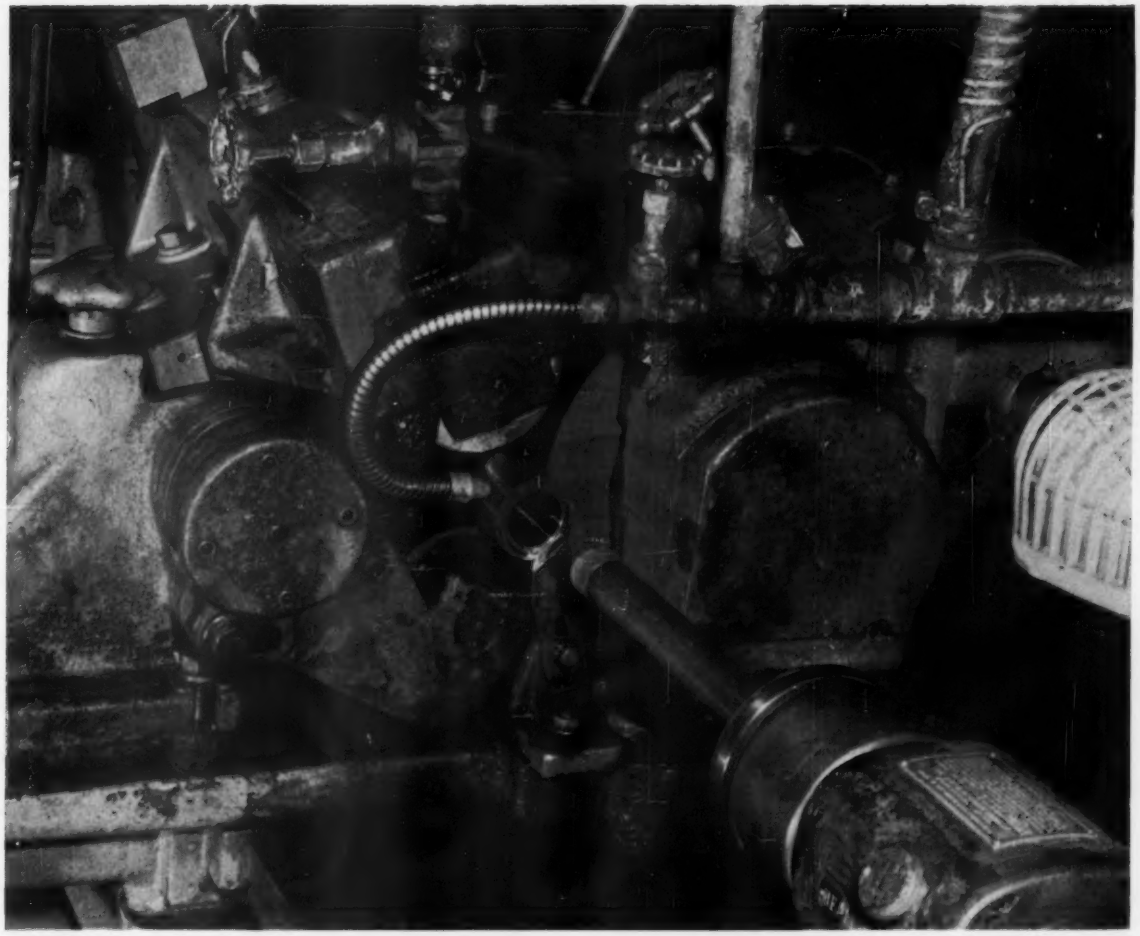
Excessive cutter breakage resulted when the cutting speeds and tooth loads indicated by available literature and Carboloy computer data were applied to profile milling. This 1½-in. cutter failed totally after removing 8.3 cu in. of metal during rough machining at 80 sfpm with a tooth load of 0.0015 ipt. It was M-3 steel

After removing 8.5 cu in. of annealed 6A1-4V titanium alloy during operation at 33.5 sfpm and 0.0045-ipt load, a 1.93-in.-dia ball-end mill looked like this. It is also M3 Type 2 HSS. It was reinserted in the spindle and removed 70.28 cu in. of metal at the same feed and speed before regrinding

The principle of quality control was also carried over into turning operations on 6A1-4V titanium. Turning tests on the alloy were run on standard equipment in the machine shop, producing a machine-requirement ratio of 3:1 based on aluminum and steel materials currently being machined. The titanium alloy showed a lower coefficient of friction and easier cutting characteristics than steel, with a good resultant surface finish as long as the tool remained sharp. Deleterious characteristics, poor thermal conductivity and a tendency to smear, were overcome by means of proper coolants, positive feeds on the equipment, and control of cutter geometry to prevent generation of heat from an incorrectly ground cutter.

Results of this test established the fact that the characteristics of titanium alloy which were once thought to be work-hardening effects were actually a combination of smearing, tool wear, and poor thermal conductivity. Titanium alloys do not work-harden as do some stainless steels.

Generally, experience at Boeing contradicts the adverse comments about machining titanium alloys. 6A1-4V can be machined in practical and relatively economical operations using, for most processes, tools and procedures currently in use for aluminum. Admittedly, many problems of basic machining and forming remain, but progress is mothered by necessity, not time. When evaluating the applicability of titanium alloys for production processes and equipment, to predict results only on the basis of one manufacturing variable is unsound both mathematically and philosophically. Until the complete picture, *the evaluation of all manufacturing variables,* is available, who can say what the future holds for titanium alloys in the airframe industry?



Solid carbide quill . . .
1½ in. OD x 16 in. long, made of Kennametal K96, for finishing the 2 3/16-in. bores of 14-in.-long solid carbide cylinder liners on Heald centerless internal grinder. Grinding time is 11 hr, compared to 20 hr with steel quill. The carbide's increased resistance to deflection caused rapid sparkout when size was reached

Machining time reduced 50% with carbide boring bars

Solid carbide boring bars and grinding quills eliminate chatter, promote longer tool life, and help maintain parallelism on long bores. Steel bushings, sleeves, and tips are brazed to carbide bars to simplify toolholding

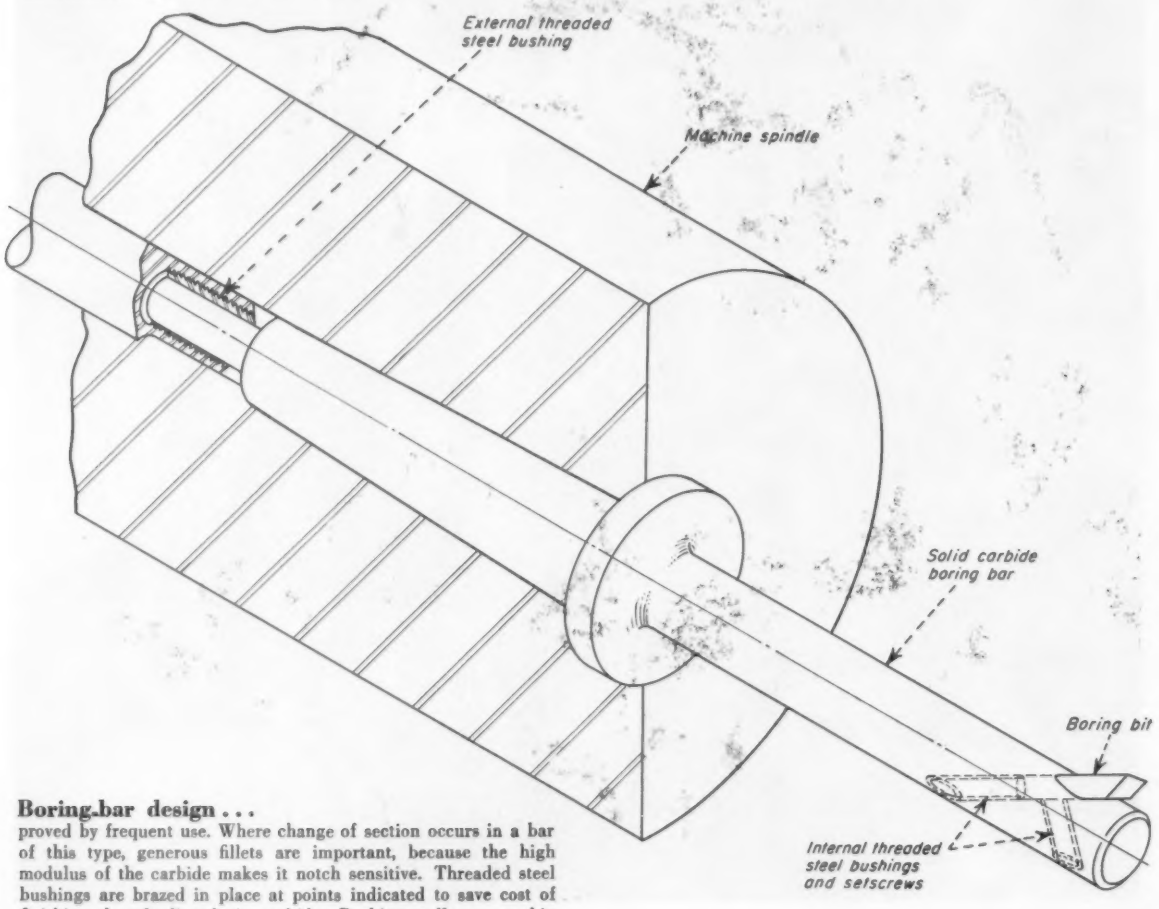
OMER W NICHOLS, project engineer,
KENNAMETAL, INC, LATROBE, PA

Precision boring and grinding of holes can often be improved by using solid cemented-carbide boring bars and internal grinding quills in place of conventional tool-steel bars. Solid carbide bars are up to three times as rigid; they have about three times the torsional strength of steel bars of the same size; and their greater density tends to dampen out any vibration set up by the machining operation.

The stiffness of a beam is a function of the modulus of elasticity of the material from which it is made, and its ability to absorb vibration depends to a large degree upon its density (specific gravity).

In both of these properties, cemented tungsten

Machining time reduced 50% with carbide boring bars . . .



Boring-bar design . . .
proved by frequent use. Where change of section occurs in a bar of this type, generous fillets are important, because the high modulus of the carbide makes it notch sensitive. Threaded steel bushings are brazed in place at points indicated to save cost of finishing threads directly in carbide. Bushing walls are so thin that the tapping operation cuts almost through the steel, and the remaining section is not strong enough to cause cracking of the carbide

carbide has a great advantage over steel. Young's modulus of elasticity for carbide is approximately 94,300,000 psi compared to 23,000,000 psi for steel, and carbide's density is about 14.8 gm per cu cm against steel's 7.8.

Chatter is almost always eliminated when boring bars and internal grinding quills are made of cemented tungsten carbide. This same result has been found when carbide is used for the shanks of single-point lathe tools (*AM*—Oct 10 '55, p144). When vibration is reduced, cutting tools and grinding wheels hold up better. Therefore, the problem of taper on long holes is either eliminated or minimized.

Another benefit is that the erosion of boring bars by the washing action of passing chips—so often a problem with steel boring bars—is virtually eliminated because of the wear resistance of carbide and because of its extreme hardness: 87 to 93 Rockwell A.

Design of boring bars and internal grinding quills incorporating solid sections of cemented tungsten carbide usually can be varied to suit job requirements. A number of proven design details adaptable to either boring bars or internal grinding quills are shown in accompanying sketches.

An important point to remember when designing solid carbide bars or quills is the need for the carbide bar to extend well into its holding device in order to take full advantage of its rigidity. Another consideration is the effect of thermal expansion and contraction. Even though the carbides by themselves will withstand considerable thermal shock, brazed joints between steel and carbide sections cannot be liquid quenched from elevated temperatures, because the resulting high stresses would, in most cases, destroy either the bond or one of the parts.

In designing joints involving cemented tungsten carbide and steel parts, the carbide should be placed inside the steel except when the steel part is only a small bushing. A shrink fit can be made with nor-

mal steel-to-steel interference, or the interference can be increased if required, provided excessive forces are not set up in the surrounding steel parts.

The shrink-braze is a suitable method for making most boring bars and grinding quills, since the heat developed by cutting operations is well within the range of normally used brazing alloys. Clearances should be calculated so optimum bond thickness is obtained at the solidus point of the braze material. For silver brazing alloys, this usually is 0.003 to 0.005 in. per joint (0.006 to 0.010 in. on a diameter) at a temperature of approximately 1200 F.

This clearance has to be adjusted to room temperature in order to determine the working dimensions of the parts. The following calculation for a 1.000-in.-dia joint between steel and carbide is a typical example:

With a coefficient of expansion of 7.0×10^{-6} for steel, and 2.5×10^{-6} for cemented tungsten carbide,

Expansion of the steel will be:

7.0×10^{-6} in./in./°F x 1.000 in. x (1200 F – 70 F) = 0.008 in.;

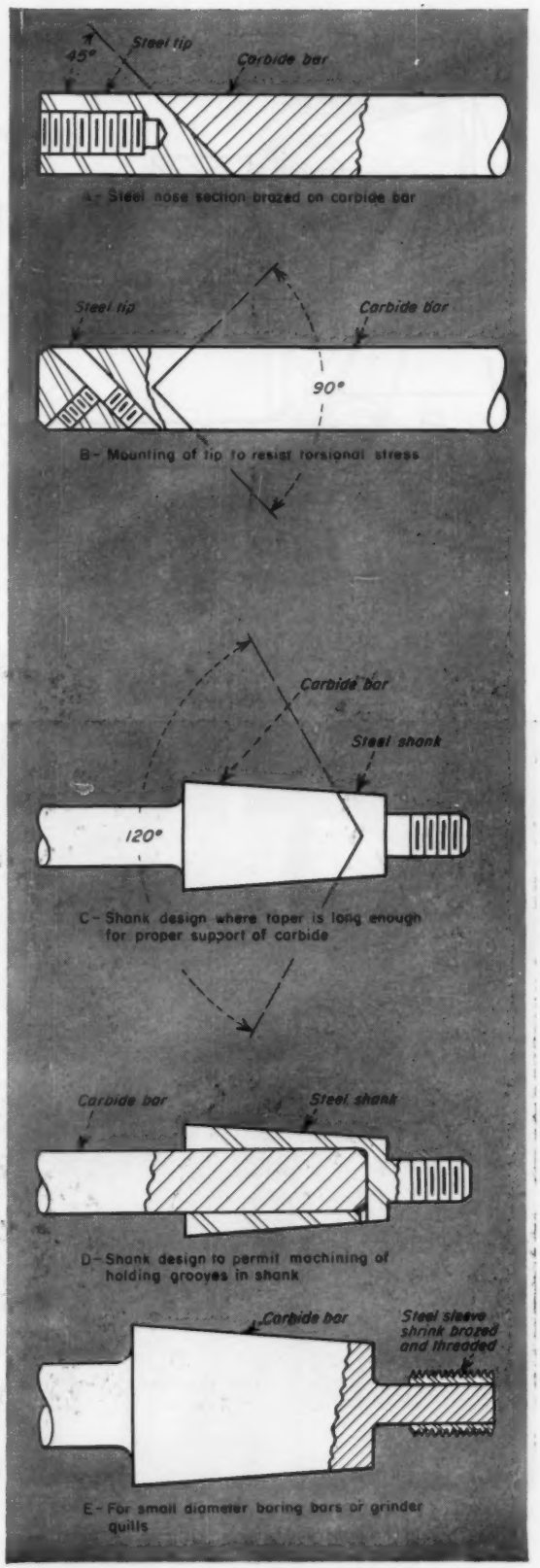
Expansion of the carbide will be:

2.5×10^{-6} in./in./°F x 1.000 in. x (1200 F – 70 F) = 0.003 in.

Therefore, with the steel outside the carbide, we must reduce the clearance by 0.005 in. for measurement at room temperature. The parts can then be made with a clearance of 0.001 to 0.005 in. and slipped together when heated to brazing temperature. On larger diameters, an interference fit would be developed at room temperature.

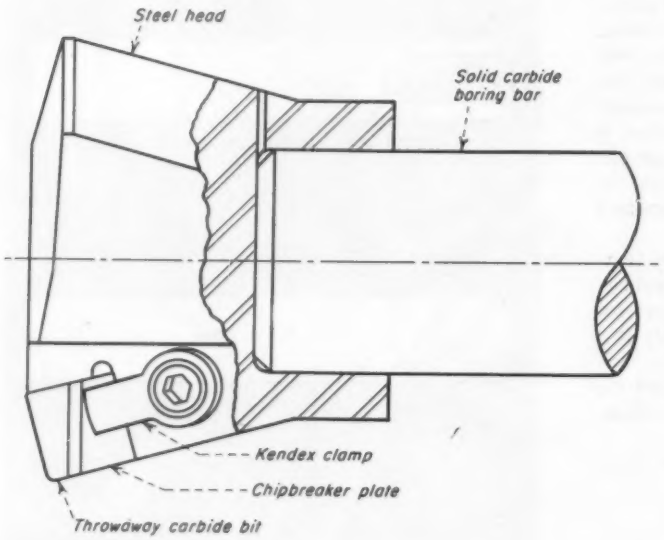
When designing bars and quills, there are limitatations with regard to ratio of length of overhang to diameter of bar for the various types of cemented tungsten carbide. Through tests, we have found that Kennametal grade K96 will withstand machining forces quite well up to a ratio of length to diameter of 12 to 1. Above this ratio, about 10% of the bar's rigidity must be sacrificed to obtain a durable item. On the other hand, bars made from Kennametal grade K95 can be used for ratios of length to diameter up to 18 to 1.

Performance tests have shown that machining time can be reduced up to 50% by using cemented tungsten carbide boring bars of the types shown, because repeated passes are not necessary to maintain parallelism of the bore with the OD of the workpiece. An additional reduction in cost is achieved because boring tools and grinding wheels last longer when vibration and cutting time are reduced.

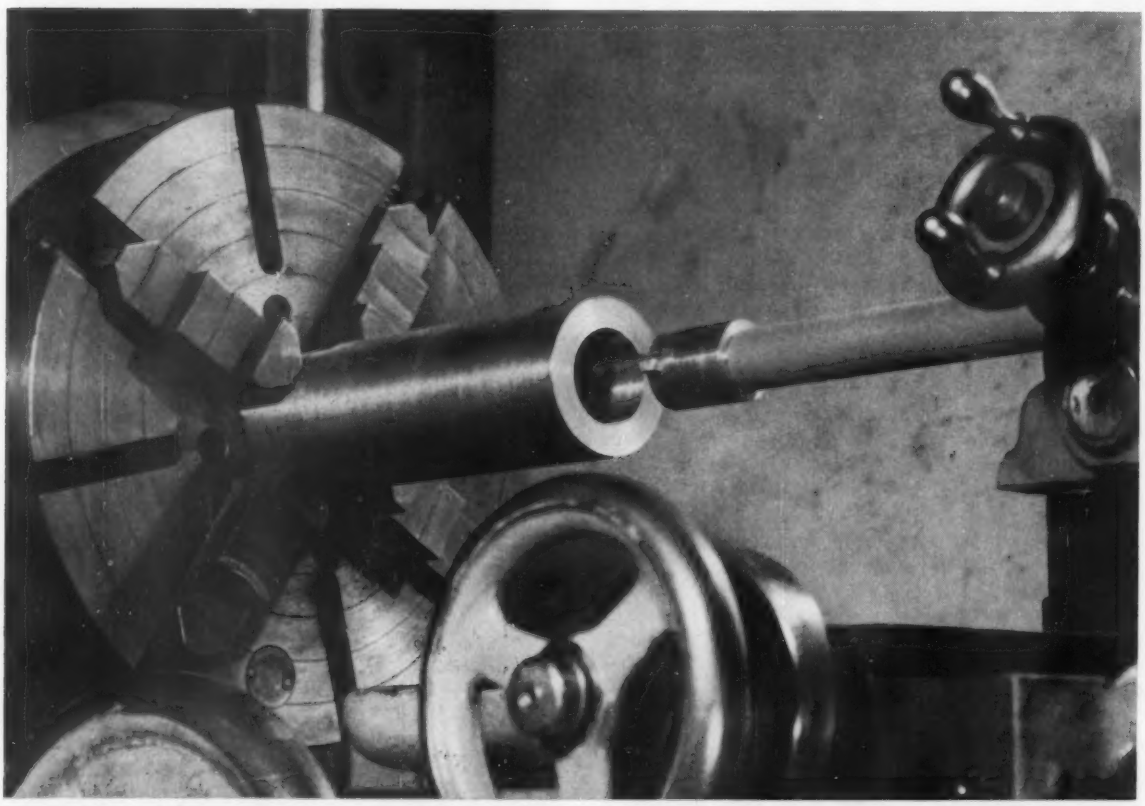

45°
Steel tip
Carbide bar
A – Steel nose section brazed on carbide bar
Steel tip
Carbide bar
90°
B – Mounting of tip to resist torsional stress
Carbide bar
Steel shank
120°
C – Shank design where taper is long enough for proper support of carbide
Carbide bar
Steel shank
D – Shank design to permit machining of holding grooves in shank
Carbide bar
Steel sleeve shrink brazed and threaded
E – For small diameter boring bars or grinder quills

Steel tips . . .
simplify the application of carbide boring bars. Design at *B* is better than that at *A* when torsional stresses are high. Shank design at *C* and *D* are for large boring bars and internal grinding quills

Machining time reduced 50% with carbide boring bars . . .



Larger carbide boring bars . . .
can be equipped for throwaway carbide bits by brazing a steel head onto the bar, then machining it with appropriate pockets, tapped holes, etc, for locating shims, holding clamps, and chipbreaker plates. With carbide shims under the bits, the hardness of the steel head is not too important. Carbide bar must enter steel head and shank far enough to insure rigid support



Steel head shrink-brazed . . .
on solid carbide boring bar holds boring bit in this setup for precision finishing the bore of a large steel cylinder. Bar is 2 in. OD, 15 in. long, and eliminates need for second pass to remove taper. Carbide bar also permits heavier cuts without chatter

Round Table

Application for Trouble

"I wish that Personnel Department would keep its sticky fingers out of my shop. They cause half of my troubles."

"Now what did they do?"

"Well, after I've just about gotten Potts broken in and familiar with our methods, they decide to fire him. Something about an irregularity on his application for employment. If they had to turn him down, they might at least have made up their so-called minds sooner; before I'd wasted all this time and effort on him."

"You know the rules, Ed. Anything phony about an employment application automatically disqualifies the man for employment here. What did he say?"

"Oh, he didn't want to put down his last employer as a reference because he had trouble with them. He filled in a fake name, and Personnel found out."

"Pretty stupid thing to do, Ed. Maybe you'd be better off without him."

"There's nothing wrong with Potts, no matter what trouble he had on his last job. He works fine, and I get along with him. I'd like to keep him. The trouble is I'd have to really raise hell to get Harrison to override Personnel, and maybe he wouldn't do it anyhow."

"He shouldn't, Ed. If a man will try to bluff out a thing like an application, he'll probably try the same thing if he makes a mistake in his work. You can't spend your time tracking down his mistakes all the time. You'd better let him go, Ed."

"Well, I'm not sure his error on the application was that important, Al. After all, he just left out one name and substituted another. I think I'd be tempted to do the same thing if I was sure the company I left would give me a bad reference."

"You might be tempted, Ed; but I'll bet you wouldn't actually do it. That's the difference between a trustworthy worker and a bad one."

"It's just the difference between a man who's not afraid to gamble and one who hasn't got the guts, Al."

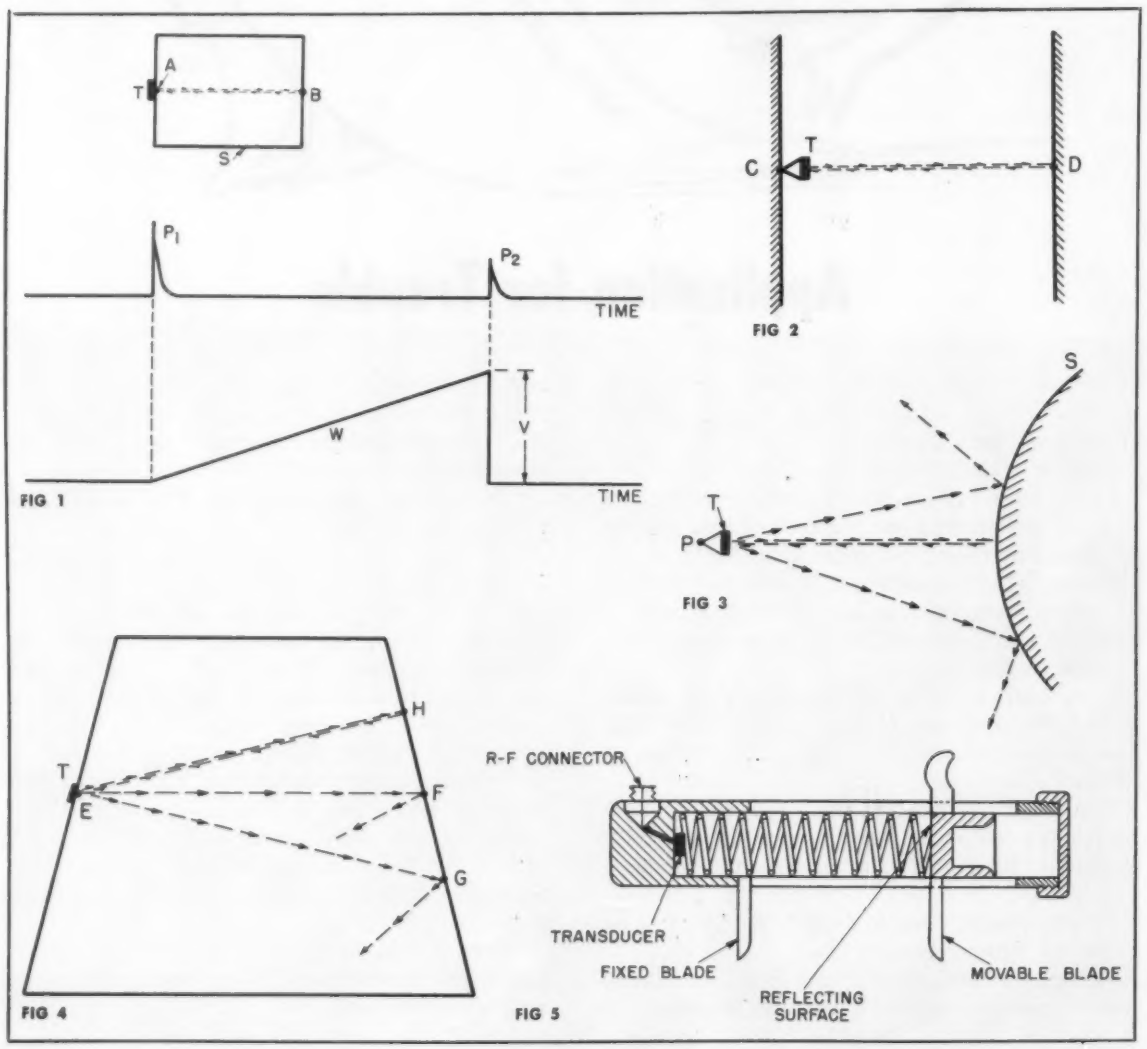
"Even if it is, do you want a man working for you when he may gamble on turning in a job with a hidden flaw?"

***SHOULD** Personnel fire Potts, or should there be some recourse, considering the fact that he's a good worker and is practically trained? Your opinions may help others with this problem. Discussions of earlier topics start on page 222.*

Can "Ultrasonic Micrometers" measure work

Ultrasonics are now doing a variety of things for us in the shop, but here is another possibility—non-commercial so far: feedback control of automatically operated machine tools in which gaging can be made part of the operation. For example, the transducer might be set up to measure the air gap between it and the revolving work surface, and hence the work diameter

H A F ROCHA, Materials & Processes Laboratory
Large Steam Turbine-Generator Dept. GENERAL ELECTRIC CO. SCHENECTADY



How Measurements Are Made Ultrasonically:

Fig. 1—Sound wave from transducer *T* traverses block *S*, echoes from *B*. Height *V* of electrical wave is a measure of thickness. Fig. 2—Gap *CD* is measured by the time required for an echo to return from *D* to transducer *T*. Fig. 3—Sound beams are reflected according to the angle of incidence, and hence the beam normal to the surface of *S* is an accurate measure of the distance between transducer and object. Fig. 4—Only the beam *TH* is reflected to the transducer, and thus distance *EF* cannot be measured with a contacting instrument. Fig. 5—The echoing surface is mechanically connected to the movable blade of the contact-thickness gage, when work surfaces are not parallel

being machined?

Our first version of the "Ultrasonic Micrometer" was originally developed as a portable instrument for measuring the wall thickness of steel objects several inches thick when only one surface is accessible. The results are shown on a meter calibrated in inches so that an unskilled worker can operate the instrument.

Here's how the device works. See Fig. 1.

Assume that we want to determine thickness *AB* of the solid object *S*. An electromechanical transducer is coupled to the object at point *A*. A short radio-frequency pulse is then applied to the transducer and transformed into a mechanical vibration which travels toward *B* on the opposite face. Upon reaching *B*, the ultrasonic vibration is reflected as an echo to the transducer and is transformed into an electrical pulse.

Initial pulse P_1 both energizes the transducer and starts a linear triangular wave *W*, which in turn is shut off by echo P_2.

The peak value *V* of the triangular wave is proportional to the time interval between P_1 and P_2 and hence to the distance *AB*.

The value of *V* is obtained from a peak detector circuit and can be displayed on a conveniently calibrated d-c voltmeter.

GAP MEASUREMENT TOO

The same principle has also been applied to the problem of gap measurement, Fig. 2. The problem is to measure the opening between points *C* and *D*. The object is immersed in a sound-conducting medium, such as water. Time interval between the transmission of the initial pulse and the reception of the echo is a linear function of the distance *CD*.

This procedure first had the disadvantage that the object must be immersed. We now use air. Strong echoes can be received from plane and curved surfaces at distances of more than one foot.

The true distance between point *P* and the surface *S*, Fig. 3, is read by the instrument, because only the part of the beam normal to *S* is reflected toward the transducer.

This non-contacting micrometer cannot be applied to measurement of the distance between two points if the echo at the far point is not directed toward the transducer, Fig. 4. The problem here is to measure distance *EF*. Only the side beam hitting at *H* will produce a useful echo, but the distance read by the instrument is *EH*, which is different from *EF*.

This limitation can be overcome by the use of a spring-loaded device—the contact micrometer, Fig 5. The reflecting surface which returns the echo to the transducer is mechanically connected to the movable blade; hence, the time needed for the sound pulse to travel from the transducer to the reflecting surface and back is proportional to the distance between the blades minus a fixed constant. A conveniently biased voltmeter can then be calibrated directly in thousands of an inch. Spring and blades can be arranged for measurement of inside or outside dimensions.

Experimental Instruments
Gap-measuring instrument weighs over 200 lb., now costs several thousand dollars, has an accuracy of 0.1%

RANGE OF MEASUREMENTS

In the case of the contact-thickness gage, the minimum measurable distance is slightly larger than the width of the initial pulse, which in turn is a function of the frequency, pulse voltage and transducer damping. These three factors, however, are conveniently chosen as to obtain a good reflection at the maximum thickness. Thus, for each set of energizing conditions, the maximum and minimum measurable thickness are interdependent functions of the absorption of sound in the object and of the quality of the acoustical coupling.

In the case of the non-contacting micrometer, the minimum measurable distance is still limited by the pulse width. However, the maximum measurable distance can be extended to any desired value by the use of extension bars. Also, by proper placement of the contacting blades the minimum measurable distance can be brought down to zero.

APPLICATIONS

One of the advantages of this type of gage is the fact that its output is a d-c voltage, which can be easily presented in a digital voltmeter, which in turn can operate an electric printer, an IBM card puncher, etc. An interesting possibility is the automatic control of machining operations.

Adapted from a paper presented before the 16th annual convention of the Society for Non-Destructive Testing.

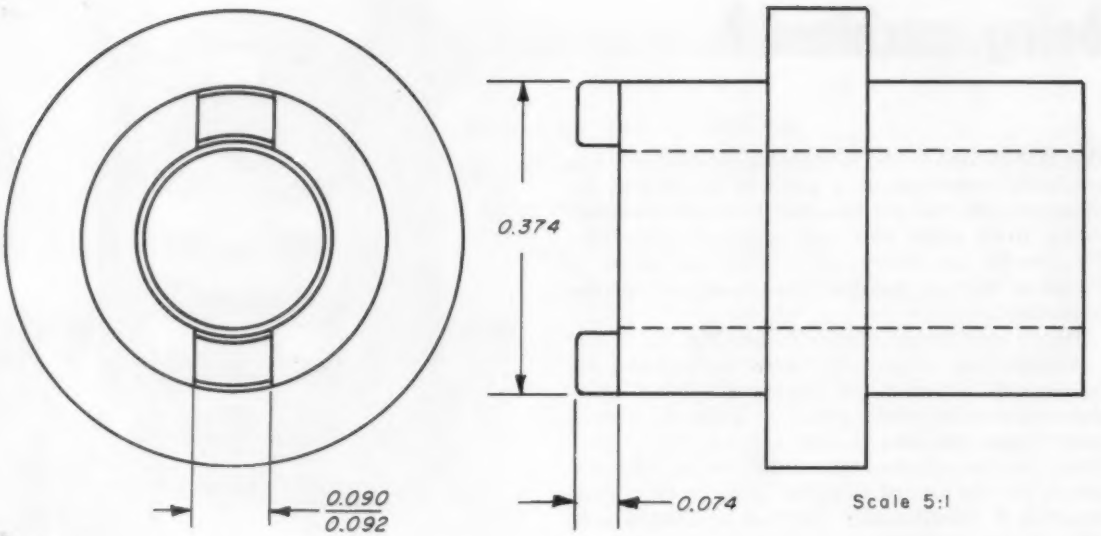


FIG. 1

How standard data improve shop estimating

RENO R COLE*

Standard estimating data are difficult to acquire and the system takes time to install. However, more and more shop people are finding in standard data an accuracy and reliability that provide much greater safety than earlier "by guess and by gosh" methods. Because of the interest in our earlier article, "Estimating Data for Turret Drillpresses (*AM*—Sept 10 '56, p 118-121), here is a description of technique plus data for estimating milling time

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In establishing direct-labor estimates and general factory requirements for several new products which were being planned for production, over a period of about three years direct labor estimates were made for several thousand machine operations of various kinds.

Each estimator used time data collected from many sources and with which he had become familiar. However, as might be expected, significant discrepancies were apparent between the estimates of different estimators and even between the estimates of the same estimator made at different times.

The group of engineers, under the direction of the writer, finally agreed to pool all data, select the best, make suitable additions from standard sources, and issue the result in a standardized and convenient form.

As the machinability of various manufacturing materials appeared as a factor in most calculations for machine time, standard tables were prepared which gave suitable speed and feed ranges for the most-used materials in their different conditions, and related to cutting tool material, type of cut (mill, drill, turn, etc), and other factors. These data were collected from the estimators and supplemented from several published sources. The

MILLING ESTIMATING DATA

45.01 GET PART

Element consists of reach from a central position, grasp part and move to fixture. (For parts up to 5 pounds.)

Distance, Fixture to Part, in.	MINUTES PER PART: Part by itself, easily grasped	Very small part lying against flat surface	Interference of grasp at bottom and side	Part jumbled with other parts
0- 6	0.012	0.014	0.017	0.017
6-12	0.018	0.019	0.022	0.022
12-24	0.027	0.031	0.031	0.031
24-36	0.043	0.044	0.047	0.047

final data were arranged in a form convenient for use, typed on vellum, and Ozalid copies were issued.

A considerable improvement in the consistency of estimates resulted from the standardization of machinability data alone. Naturally, some judgment still had to be exercised by the estimators in the selection of values from the ranges given in the data. Thus some experience still was required to decide the probable rigidity of the fixture and machine, probable use of coolant, and similar variables.

Estimates of milling-machine operations, because of the relative complexity and number of factors involved in this type of operation, exhibited frequent and serious discrepancies. Therefore, the data for milling-machine operations were standardized next.

To show the general standardization effort, the milling operation data which were finally produced are given herewith. These data should be useful to anyone estimating milling operations, although it may be found desirable to modify them somewhat to suit conditions in a particular shop. The data are intended to cover light and medium milling-machine operations for parts up to about five pounds in weight. Suitable adjustments could, however, be made in the data to cover larger parts.

The data are based on 100% equals normal effort. However, actual performance against estimates made with the data will vary in different factories and shops in accord with such factors as use of incentive systems, efficiency of supervision, quality of tooling, and condition of machine tools.

Actual use of the data can best be demonstrated by an example: Figure (1) shows a small steel gear blank in which a driving tongue is to be milled. The form 45.14 demonstrates how the values are determined and how the data are used. A small, automatic-cycle milling machine with rapid traverse, feed, automatic rapid traverse return, and stop was selected. Application of the data should be fairly obvious down to 45.06.

At this point some knowledge of milling operations is required in selecting the straddle-mill cutters from a catalog. In this case, 2½-in.-dia cutters having 14 teeth have been used. A cutting speed of 210 sfpm with a feed per tooth of 0.007 in. was found in the machinability table for the AISI

45.02 LOAD AND UNLOAD FIXTURE

Element consists of placing part in nest, clamping fixture, unclamping fixture and removing part

Select time from "locate and remove part in fixture" (45.021) and add to time for clamping and unclamping (45.022)

45.021 LOCATE AND REMOVE PART FROM FIXTURE.

Includes orient part for loading

	MIN/PART
1. Part loads same side up but no particular location.	0.040
2. Definite location, easy fit.	0.065
3. Definite location, close fit or larger more complicated part	0.085

45.022 CLAMP AND UNCLAMPED FIXTURE

	MIN
Bayonet, hinge plate, strap clamp or any friction restrained sliding member, sliding not over 2 in.	0.050 per clamp
Strap clamp when nut or screw is completely removed	0.297 per clamp
Cam lock or lever	0.042 per clamp
Set screw, (4) turns only	0.187 per screw
Bolt with horseshoe washer	0.244 per bolt
Set screw—remove completely and replace	0.340 per screw
Open and close vise	0.042 per vise
Add to above for tapping in vise with mallet	0.049 per spot

45.03 START AND STOP SPINDLE

This element is used only when a safety hazard would be involved in loading or unloading the fixture with the spindle running.

	MIN FOR START AND STOP SPINDLE
For pushbutton operation	0.022
For lever operation	0.075

PLEASE TURN PAGE

B-1113 steel. However, because of the nature of the fixture, 0.005 in. feed per tooth was used.

Calculation showed a 2½-in.-dia cutter would have a speed of 320 rpm to give a cutting speed of 210 sfpm. The closest spindle speed on this miller was 350 rpm. This speed was used and the cutting speed was corrected to 229 sfpm correspondingly. The approach distance was calculated as equal to: d (D − d), where d = depth of cut and D = diameter of cutter: 0.074 (2.5 − 0.074) = 0.423.

The length of feed was calculated by assuming an over-travel of ⅛ in. and adding twice this to the approach distance and to the length of cut: 2 × 0.125 + 0.423 + 0.374 = 1.047. Selection of the remaining values on the form 45.14 can be followed from the data. The final allowed time in minutes per piece is multiplied by the factor 16.667 to convert to the estimated standard of 5.42 hours per thousand pieces.

It is interesting to note that the calculations under 45.06 can now be made automatically on simple electric computers. A standard desk calculator can, however, be used for all the calculations and will aid in establishing consistency.

It was found that the use of such standard data setups as illustrated here provided extra dividends which were not anticipated when the work was undertaken. Consistency was achieved by group use of the same data. In addition, use of forms such as 45.14 eliminated the omissions of important elements which the estimators had been prone to make as a result of oversights. A most pleasing result was the much greater facility with which inexperienced and younger men could be trained in estimating work by use of such data.

Acknowledgment: Some of the data used were taken by permission from "Machine Shop Estimating" by Nordhoff and "Methods—Time Measurement" by Maynard, Stegemeerten and Schwab (McGraw-Hill)

45.04 START AND STOP FEED

45.041 Start feed is always used — 0.022 min

45.042 Stop feed is usually automatic and no time is required except in feeds which have no auto-stop or when feeding to a tolerance closer than ±0.005 when the dial is used. — 0.022 min

For non-automatic mills the value of start feed must be used 3 times: to start rapid traverse, to start feed and to start return rapid traverse. This is not true of automatic-production mills.

45.05 TRAVERSE, TOTAL

The total traverse is defined as the rapid approach and retraction of the table under power or by hand and is exclusive of the motion during feed.

LENGTH OF TRAVERSE = 2K + FEED DISTANCE

K is the traverse distance to start of feed and is the distance the fixture must be from the cutter to permit convenient and safe loading and unloading.

TOTAL TRAVERSE TIME, MIN. = TRAVERSE MIN/IN. × LENGTH OF TRAVERSE, IN.

Traverse, min/in., is as follows:

Hand traverse	0.0220
Small automatic production type mills, rapid traverse	0.0018
Medium size mills, rapid traverse	0.0067

Data for machines may be found in the *Machine Tool Data Sheets* for the machines concerned.

45.062 Choose a standard catalog cutter and note diameter and number of teeth. In addition to selecting a cutter size physically able to accomplish the work (¼ in. clearance is usually allowed between the arbor and work to allow for thickness of sleeve and clearance), the following should be considered:

Reasons for Smallest Diameter Cutters	Reasons for Largest Diameter Cutters
1. Less grinding time	1. Longer life between grinds
2. Shorter lever arm—less tendency to chatter	2. Higher sfpm for same rpm
3. Lower cost	
4. Less approach distance	3. Permits use of larger and stiffer arbor
5. Lower sfpm from same rpm	

Determine the cutter surface speed and feed per tooth (chip load) for the material being machined from the machinability tables. Select the nearest machine rpm as follows:

$$\text{rpm} = \frac{3.820 \text{ sfpm}}{\text{cutter dia in.}}$$

Then calculate the corrected sfpm:

sfpm (ft/min.) = 0.2618 rpm* × cutter dia

*nearest rpm of machine to rpm calculated above

Calculate ipm feed of table:

ipm = no. teeth × corrected rpm* × feed per tooth (chip load) in.

Calculate length of feed:

Length of feed = 2 × overtravel + approach + length of cut. (If cutter is to be fed through for surface finish considerations an additional approach distance must be added.) See Fig. 1. Overtravel usually = ⅛ in.

Calculate cutting time for milling:

Cutting time, min. = length of feed, in.—feed, in./min.

45.07 RELIEVE CUTTER FOR BACK TRAVERSE

Element consists of turning crank to lower knee or move table crosswise on knee and resetting table either traversely or vertically to a dial setting. This element is only necessary where surface finish would be unacceptably affected by the cutter mark caused by rotation of the cutter during back traverse.

Use 0.167 min. for all mills

45.08 AIR CLEAN

Element consists of cleaning the fixtures and /or the part with air.

Min/part = 0.014 + 0.027 N

Where N = number of blasts needed.

45.09 DISPOSE PART

Element consists of move part to container, release and move hand back to central position. (For parts up to 5 lbs.)

Distance, fixture to container	Toss part	Minutes per part: Move to approx location, tote-box, etc	Minutes per part: Place in location peg board, etc
0-12	0.014	0.017	0.021
12-24	0.024	0.025	0.029
24-36		0.039	0.043
36-48		0.055	0.059
48-60		0.070	0.074
60-72		0.085	0.089

45.10 GAGE

This element is only allowed when machine time is insufficient for gaging and gaging is to be done by the operator.

Frequency of Gaging: Total Tolerance	Frequency of Gaging: % Gaged	Time required to Gage: Type of Gage	Time required to Gage: Min/Gaging
0.0005 - 0.001	100	Scale	0.10
0.001 - 0.002	20	Outside micrometer	0.15
0.002 - 0.003	10	Inside micrometer	0.30
0.003 - 0.004	7	Depth micrometer	0.20
0.004 - 0.005	5	Dial micrometer	0.30
0.005 - 0.010	4	Snap gage	0.10
0.010 - 0.020	2	Pin gage	0.20
0.020 - 0.062	1	Plug gage	0.20

45.14 – TIME ESTIMATE SHEET FOR MILLING

PART NAME *CARRIAGE-SHIFT DRIVE GEAR* MACHINE *NICHOLS MILL* PART NO. *71689*

OPERATION *MILL DRIVE TONGUE* OPERATION NO. *60*

TOOL DESCRIPTION *MILL FIXTURE: PILOT WITH SLIDING HAND CLAMP*

MATERIAL *STEEL, AISI B-1113* GET DIST. *12* IN; DISPOSE DIST. *12* IN; HANDLING; EASY ✓ HARD __ SYM ✓ NON SYM. __

		EL. TIME. MIN/PC
45.01	GET PART	0 2 2 0
45.02	LOAD AND UNLOAD FIXTURE .065 45.021 .050 45.022	1 1 5 0
45.03	START AND STOP SPINDLE	
45.04	START AND STOP FEED	0 2 2 0
45.05	TRAVERSE, TOTAL 13.047 (2×6+1.047) IN. .0018 MIN/IN.	0 2 3 5
45.06	MILL: CUTTER DIAM. 2.5 (1) IN., SFM ~~240~~ 229 (2) NO. TEETH 14 (3) RPM 350 (4) (3.82×210=321 / 2.5 / 350 CLOSEST) FEED/TOOTH .005 (5) IN., FEED IN./MIN. 24.5 (6) LENGTH OF FEED 1.047 (7) IN. (1)×(4)×.2618=(2); (3)×(4)×(5)=(6); (7)÷(6)=EL. TIME, MIN.	0 4 2 7
45.07	RELIEVE CUTTER FOR BACK TRAVERSE	
45.08	AIR CLEAN .014+.027	0 4 1 0
45.09	DISPOSE PART	0 1 4 0
45.10	GAGE AND/OR OTHER	
	TOTAL UNIT TIME	2 8 0 2
45.11	ALLOWANCES: PERSONAL 4 % FATIGUE 4 % TOOL 8 OTHER ___ TOTAL 16 %	0 4 4 8
	16.667 × TOTAL ALLOWED TIME	3 2 5 0

BY *HC* REF. FROM: REF. TO: ___

DATE *9-29-55* PART NO. ___

OPERATION NO. ___

TS 140
7-20-54 DATE CARD POSTED ___ BY ___

	EQUIP. CODE	RATE HRS/1000	LABOR CODE
OLD			
NEW	03.31	5.42	02

"Traffic-cop" television tips guard . . . when trucks leave factory loading docks—so he can open gates and prevent jams. Fixed camera is located 60 ft behind him, trained on ramp. Guard can control incoming trucks and personnel by seeing directly through window, but has added vision beyond his normal range

Industrial TV for better vision

CHARLES EMERSON, associate editor

Remote viewing is something you can do with a telescope, or with mirrors; but it can now be done with television, which has unique advantages. TV is an expensive toy, but may be a valuable tool if it's applied right. A closed-circuit system can be handled without specially trained personnel, and without servicing worries. Following is a roundup on what you can do with it . . .

Closed-circuit television operates through wire from the camera to the receiver, not through the air like commercial TV. Therefore, it is not subject to the same atmospheric conditions that sometimes interfere with broadcast TV, and the TV closed-circuit system, or chain, is more reliable and simpler.

The most elementary chain starts with three segments; a camera with a pickup tube and preamplifier, a control unit with a main amplifier and power supply, and a receiver. Any two or all of these elements may be combined in a single unit; or all three may be separate. A low-budget chain might cost around $1200; but you'd have to

add a good lens (at $100) and some cable to connect the elements.

Optional equipment such as lens turrets, remote controls, multiple cameras and receivers, and special-effects units naturally raise the cost. More expensive basic systems are also available, and may be warranted if the application demands high performance.

HOW IT WORKS

A closed-circuit chain is a miniature, simplified version of broadcast TV. A camera tube, usually the vidicon type, picks up an image through the lens system and feeds an electronic signal to the preamplifier. This forwards the signal to the main amplifier, which relays it to the receiver; and there the signal is converted back into a visual image.

The system is not expensvie to operate; the power supply is usually rated at around 200 watts, and the receiver probably draws a bit less. All elements are portable if they're disconnected, which allows setting up the system in a new location for a different function. Of course the connecting cable must be rerouted, which may be a headache; but the user is not restricted to a single location.

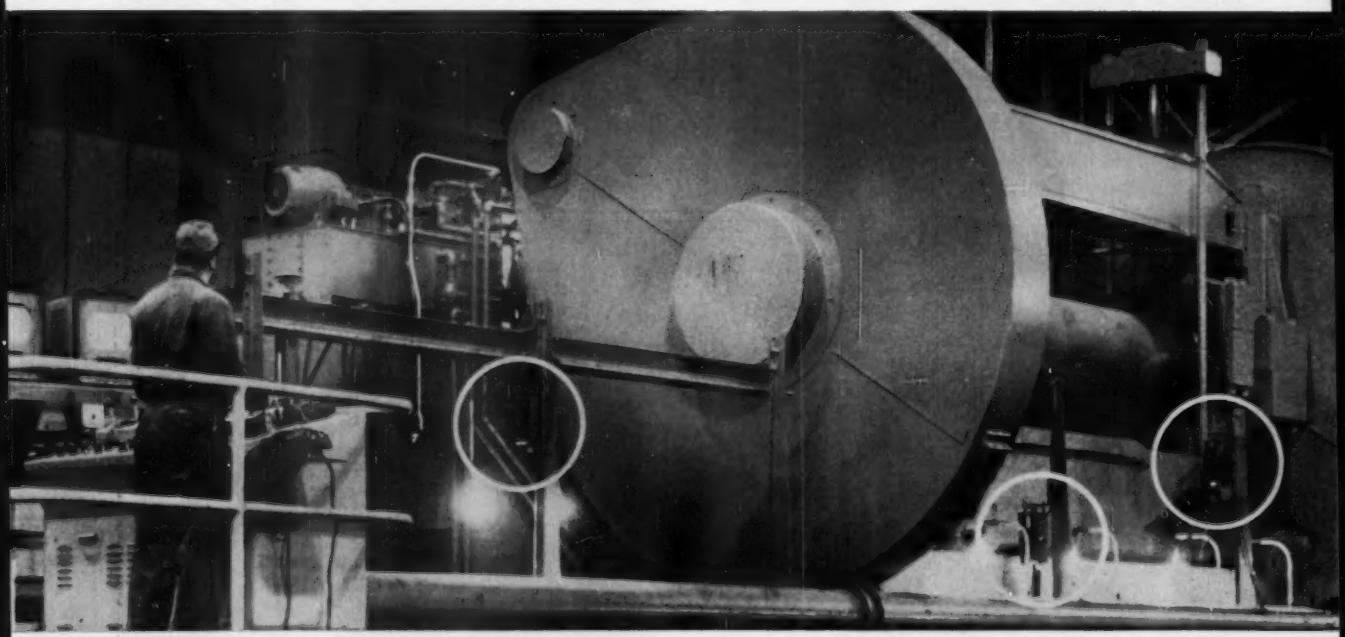
Servicing is not a severe problem because several equipment manufacturers have their own factory-operated service organizations or are connected with nation-wide servicing companies. Most competent TV servicemen can handle repairs, too, and many can make minor circuit changes when and if these are required. Assuming an initial setup by the manufacturer, who would also instruct operators on adjustments and tube replacements, a TV system should operate easily and well for a long time. Day-to-day adjustments are straightworward and often not necessary.

WHERE TO APPLY IT

Industrial television is a seeing and reporting device. Just as facts and figures can be gathered remotely and reported back to a main office by telephone, telegraph, or teletype, so visible scenes can be focused and relayed to a central office by television. The advantages of TV are instant reporting, accuracy (because the view is direct, not repeated or reproduced), and the ability to view areas that may not otherwise be seen at all.

Television is not a specific tool for Metalworking, because most of its applications in production shops are much like those in other factories and industries. In few cases is there much point in viewing a metal-cutting operation through TV, unless it is a remote-controlled operation on radioactive materials, or perhaps a demonstration of technique or new equipment to be viewed by a large number of observers. Television makes sense when you have to actually see something going on, while it's going on, at a point where it isn't safe, convenient, or economical to send a man to look.

For example: Railroads have installed a number of chains with cameras spotted in switching yards where they can scan serial numbers of boxcars being shunted into sidings. Receivers in control offices show this identification to clerks, who can see which cars are on hand without waiting for a man to bring



Three cameras on giant shear . . . give operator remote views of turntable and stock so he can jockey alloy-steel plates into cutting position. One camera provides view of stock gage. Installation is at Lukens Steel Co

Industrial TV for better vision . . .

in an invoice. This allows faster car handling, simpler scheduling and routing, and less bulky records.

In many industries it can be a help, and in some cases a necessity, for an operator to see a point on a machine that would normally not be visible while he is operating that machine. A large shear, for example, can be controlled more quickly and accurately if the operator has a camera trained on the blade or the stock gage, and a receiver at his control station. When stock is lined up properly, he can trip the machine without waiting for a second operator to relay an "OK."

A power-plant operator might want a constant check on instruments and gages remotely located from his normal station at the main control panel. With closed-circuit television, he could position a camera to pick up these readings, and install a receiver at the main panel to show them. Thus he might be able to save several steps a day—or perhaps prevent damage to expensive equipment because he has the remote instruments constantly in view.

DANGEROUS AREAS

There are more critical applications for television. A camera is much less vulnerable to damage in a plant than a man, and a camera in an explosion-proof housing is practically indestructible. It may be moved into an oven, a gas-filled enclosure, or a furnace to feed back visual data to a safe location. The camera may be mounted on a track and powered into its viewing location, or may be left there, depending on circumstances. This can now be done with color television, which might be exploited to show the condition of flames, or to indicate heat values, or perhaps to show the surface condition of a product while the work is still inside an enclosure.

TV opens up a number of new possibilities for inspection, checking, and identifying that up to now have never been considered. Manufacturers of the equipment frankly admit that it is difficult for them to suggest new uses because a healthy imagination must be coupled with solid knowledge of the plant or process to pick out a new application. The most fruitful attempts to apply closed-circuit television will probably come about after a potential user asks, "can it do thus and so?", and the manufacturer has to try it out.

ACCESSORIES

The basic TV chain is normally quoted at a price not including the lens and cable to connect the units. Most often the quote is only for the camera and power-control unit; not including the receiver.

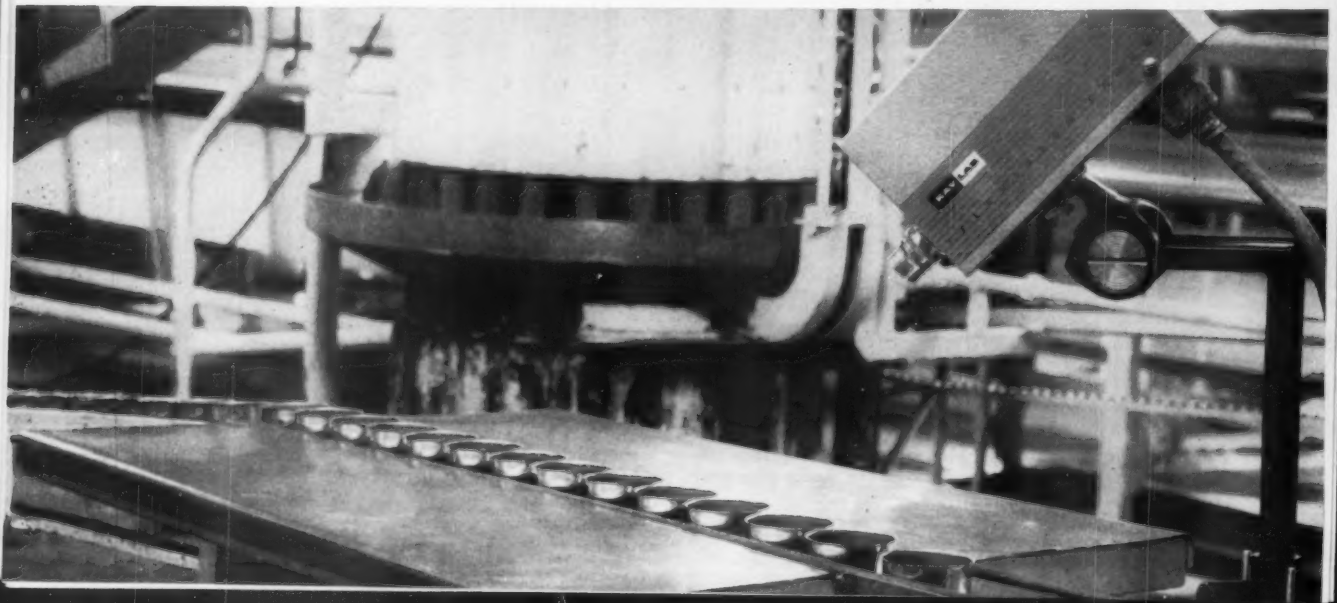
Practically all TV cameras use type C 16-mm lenses, which is a size common to 16-mm movie cameras, and is therefore universally available. Even the simplest fixed-focus lens costs around $100, however; but for a good reason. Lens quality must be high because the camera may have to work at relatively low light levels—30 footcandles or under—inside shop and factory buildings.

More elaborate lenses allow more elaborate results. If closeups or wide angles are needed, the camera may be fitted with a three-lens turret for normal, wide-angle, and telephoto viewing. Zoom lenses are also made for TV work, and are valuable when a continuous picture must be maintained while the lens is adjusted from a long shot to a closeup.

Power can be applied to all possible camera functions. The camera may be panned left and right, tilted up or down, the iris opening can be adjusted to new conditions of light, focus can be changed, zoom mechanisms operated, and lens turrets indexed.

Special housings are available for outdoor installations—even with windshield wipers. Explosion-

Conveyor view keeps tabs on production rate . . . and continuity. Installation requires no adjustments and will work at fairly low light level. If conveyor jams for any reason, camera will transmit picture to viewer to help locate the trouble



resistant cases and camera enclosures with forced-air ventilation are also available.

DISTRIBUTION

The signal that produces a TV picture can be forwarded from the control power unit in two ways:

Video signals, the same that come direct from the camera, can be amplified and sent on to the viewer. If the TV receiver is a special monitor, it will accept video signals, or a commercial receiver can be converted to accept video. This requires a competent TV technician, which the local TV serviceman may or may not be. Video signals are simple and effective as long as the receiver is not too remote from the control unit. To span a long distance, video signals must be amplified by repeater, or line, amplifiers every several thousand feet.

RF signals, the same as those broadcast through the air by the commercial TV stations, can be sent through wire directly into a commercial TV receiver that needs no conversion. Signals come through on channels 2 through 6. RF signals must be changed from video by a conversion unit, which many industrial TV systems include as standard equipment. For long distances, RF requires amplifiers every few thousand feet. Cost of coaxial cable for RF signals is around 35 cents per ft; around $2.50 per ft for video.

REMOTE CONTROL

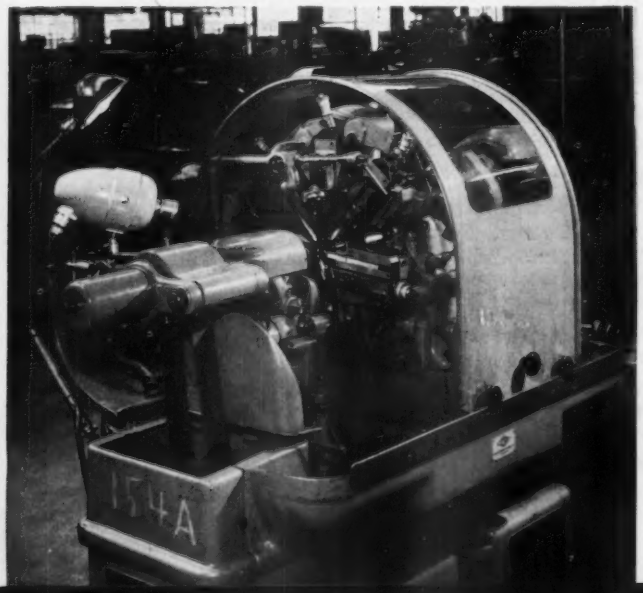
If any powered function is applied to the camera, this may be controlled through cable from the power-control unit, or from the TV receiver being used. If the system uses video signals, connecting cable may be bulky and expensive. For long distances, RF signals can be sent through the same thin cable used for the picture signal to control relays at the power unit to control motors on the camera. Sometimes this kind of remote-control setup can be routed through TV-antenna distribution systems in large buildings—such as used for running commercial TV signals from a single main antenna to a large number of TV sets in the building. The same network of RF cables can be installed in a plant to allow hooking up a TV camera in a number of locations, and to allow hooking in several receivers that may be moved to other locations. This is probably the most flexible type of industrial TV system—and the most expensive.

In addition to camera control, an RF distribution system will allow controlling other equipment, too. Remote doors, machinery controls, and locks can be operated this way, with only a single cable connecting the TV receiver and a control box with the remote camera and power unit.

An important point to possible future users of industrial TV is this: If plans are made to include RF distribution in a new building, installation cost is much less than if the network is added later. The same goes for a video system, which requires heavier cables and more line amplifiers.

Remote control tied in with remote viewing—to see what control is needed, and to feed back information after the controlling has been done—is a new concept that may well change many current operating procedures. One way to control a remote operation is to install complex feedback instrumentation to signal when the control has been accomplished; but another more flexible way to do the job is to use TV to see what happened, and to give warning if the control failed.

Camera plus ordinary machine lamp . . . produce continuous picture of screw machine—for production check, training, or identification in case of trouble. Camera is close enough to show parts, but not close enough to be spattered



APPLICATIONS

Here are several ideas that may or may not be practical in industry. In either case, they show the kind of thing industrial TV can be used for, and may suggest other, more immediate applications of practical value:

Plug-in TV on highly automated production lines—with RF distribution a camera can be brought in to watch any given operation or machine for a period of time to detect machine malfunction. With future tape recording of television pictures, this information may be played back for analysis by engineers. TV should have advantages over movies because the camera could be controlled by viewers in a remote office, giving them a choice of picture and leeway in examining the equipment.

Rail-mounted TV in storage department or shipping area—with powered overhead trolley carrying the camera, a remote-controlled pickup could find stored items in less time than a walking man; and could allow quick, frequent inventories.

Underfloor TV to check stock ejection in a press line—a single fixed camera at one end of a conveyor tunnel could give information in case of jams, or a powered movable camera would inspect under each press—and might also show how press springs and supports were acting.

Inspection TV—to show detailed picture on re-

ceiver located at inspection station. Camera can be teamed with a microscope, or equipped with lenses to give enlarged view of parts difficult to check with unaided eye.

Security TV—to guard plant roofs against fires, or long factory walls and fences against penetration. Cameras can scan long distances from central installations quicker than a guard on foot or in a car. With adequate lighting, and possibly remote iris control to maintain a uniform picture in spite of changes in lighting and shadows, a camera can pick up movement even at night.

Another security idea — inspect incoming and outgoing personnel to detect thievery. This can be an adjunct to guards; not a replacement.

Remote guarding—as in separated power plants and warehouses. Guard at main building or in a gatehouse could have view inside or outside company-owned building far away. At any alarm or disturbance, he could send a guard in a car to make close inspection.

In-process inspection—to show office personnel or management present state of equipment being erected on plant floor; to help scheduling, planning, and to catch emergencies earlier.

Two-way communication — between offices in plant, where visual factor would help. If engineers could talk and show parts of drawings at the same time, without traveling back and forth, time savings might write off TV costs.

POINTS TO JUDGE

In a rough non-technical way this is what happens inside a television picture tube:

The main element (gun) fires a stream of electrons at the inside face of the tube, which is coated with a phosphor to glow. The stream is deflected by the receiver circuit so it first hits the upper left-hand corner of the screen (seen from the front), then moves horizontally across the screen. When the stream reaches the right-hand side of the screen, it switches back to start position, indexes down, and traces another horizontal line. It keeps tracing horizontal lines like this until it gets down to the bottom, then it switches back to start position and repeats the pattern.

This is what happens when you cut down the contrast and increase the brightness in a home receiver; producing an all-white picture. To get a real image that means something, the beam is controlled (or modulated) by a signal from the camera tube so it traces a horizontal line that varies from full white to faint gray to no line at all. This agrees exactly with a line across the view that the camera tube sees. The result is a visible picture much like a black-and-white photograph.

Commercial TV works to certain standards that many industrial-TV systems also use:

525 horizontal lines from top to bottom of the picture

60 complete scans over the screen per second. Thus, the beam traces 60x525 horizontal lines on the screen per second.

Resolution power is important, because it controls the fineness or detail in the picture you get from the camera to the receiver. In many applications high resolution is necessary; in others it would be a waste of money.

This factor is also rated in lines. It means the maximum number of closely-packed vertical lines that can be shown in detail across the face of the screen. In other words, the maximum number of times the beam can be turned on and off as it traces across the screen. This ranges from a low of 300 lines to a maximum of 1200 (a special system), but the average is around 500.

Another factor is interlace. If the picture is interlaced, the beam traces two complete pictures in succession; one with its horizontal lines squeezed between the horizontal lines of the other. This increases detail in the picture, and is also something that may be useful. Commercial television uses interlaced pictures.

Video is the name applied to the signal received from the TV camera. In commercial TV, video is converted to RF (radio-frequency) signals before being broadcast through the air. RF can also be used in industrial TV, but straight video may also be used because the signal only has to go through a cable and is never broadcast.

Picture quality may be rough or in fine detail, depending on the type of system used. One specialized (and expensive) setup actually can produce a picture that is better than a human eye can see under the same circumstances. It will show a usable picture if the subject is illuminated only by 0.001 footcandle—which means the TV camera can see without being seen.

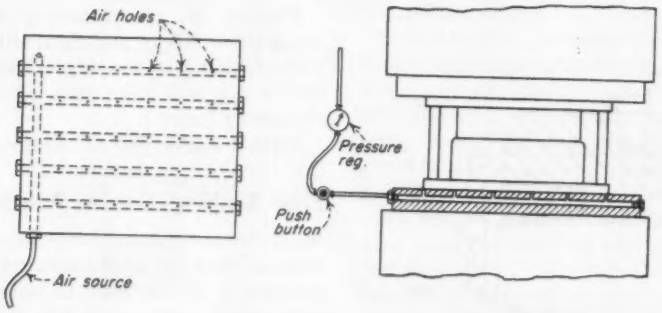
TV works well in extreme lighting, too. Camera and receiver adjustments compensate if the light level is quite high. One caution is important; outdoor cameras should be arranged or guided so they do not face directly into the sun.

Truly-portable cameras are now available—as used during last-year's political conventions; and a camera using transistors has been announced. One imported tv camera is only 2 in. in dia, and can be sent through boiler tubes for inspection purposes.

We would like to thank the following organizations for their help in preparing this article:

Blonder-Tongue Laboratories
Dage Television Div, Thompson Products Co
Diamond Power Specialty Corp
Dumont Laboratories
General Electric Co
General Precision Laboratories
Industrial Security Institute
Jerrold Electronics Corp
Kay Lab
Radio Corporation of America
Zenith Radio Corp
Zoomar, Inc

Practical Ideas . . .



Air Aids Positioning of Heavy Dies

Moving and positioning heavy and bulky dies has always presented a problem. Many presses restrict movement because of side frames, gates, or guards; sometimes requiring several men to do the final pulling and hauling.

A simple and inexpensive cure is to use the supporting power of air pressure. This has long been done in jig and fixture work. We have adapted the idea to the power press.

As the sketch shows, several 5/16-in. holes were drilled across the plate and tapped for ¼-in. pipe plugs in each end. One hole was drilled from a neutral edge to connect the others. This hole was opened up to 7/16 in. and tapped to connect to the air supply. On 2-in. centers vertical 1/16-in. dia holes were drilled to intersect the main holes.

The main holes were plugged, and an airline was connected to the inlet hole. The addition of a pressure regulator, plus a pushbutton on-off valve completes the job.

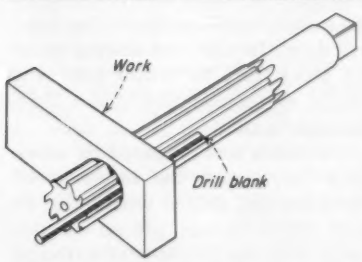
The regulator is used because full shop pressure is not required for most dies. We kept ours at 40 psi and it works well. The noise from the rush of compressed air is negligible at this pressure.

The pushbutton valve is a safety measure because the die being positioned must be stopped instantly. The valve is located on a 6 ft. length of hose, permitting the operator to move around the press while positioning the die.

It is not necessary for the die to cover all the holes. We have found that with half the holes not covered, the slight loss of pressure through the exposed holes does not affect the movement of the die.

Where the press to be converted has an extra large bolster, it may be advisable to put two hole patterns in with separate control valves. The flow of air may then be directed to the section covered by the die.

Henry H Ramm, Columbia, Conn.



Oversize Holes Made With Standard Reamer

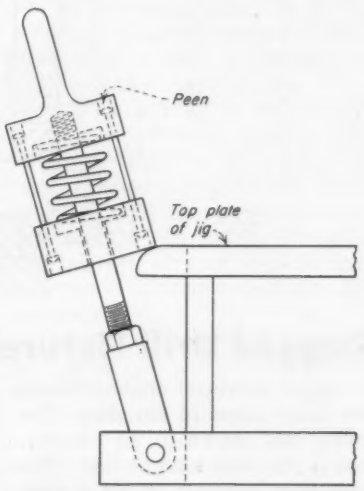
It may sometime be desirable to enlarge an already reamed hole several thousandths beyond standard size. If an expanding reamer is not available the job can still be done with a standard hand reamer of the nominal size of the hole.

To do this, I use a set of wire-gage drill blanks. The reamer is first inserted into its hole, and a drill blank is tried between the flutes. The blank that enters snugly is measured, and one a couple of thousandths larger in dia is used in the same flute.

To enlarge a hole by this method, the reamer and the drill blank are inserted at the same time. While the blank is held in the flute, the reamer is carefully turned in line with the axis of the hole.

If it is necessary to enlarge the hole still further, the process can be repeated with slightly larger drill blanks. In the absence of drill blanks, any wire or light rod may be used.

H J Gerber, Stillwater, Oklahoma



Drill Jig Clamped By Spring Lock

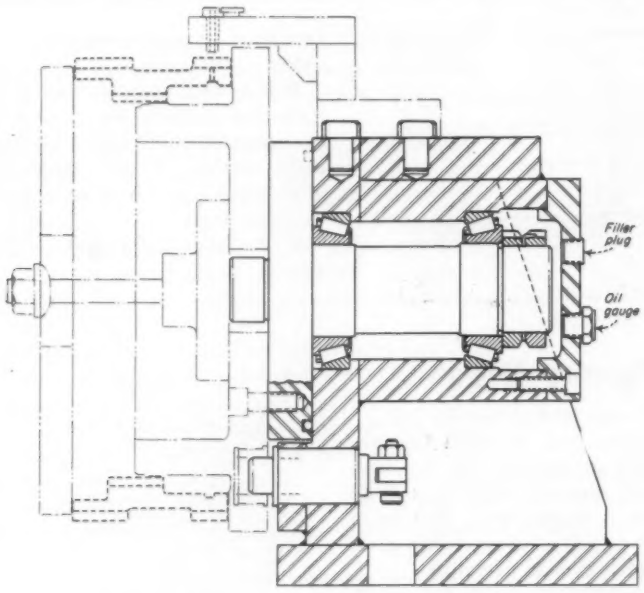
Most box-type drill jigs have a top plate in which the drill bushings are located. This plate must be opened and closed each time a workpiece is loaded into the jig. A thumbscrew is usually employed to lock the plate while drilling.

The spring-loaded locking device illustrated can quickly be snapped over the plate to hold it securely. This eliminates a lot of time lost in loosening and tightening a thumbscrew. Should the top plate be used to hold or locate work while drilling, the constant pressure maintained by the spring action will promote more accurate seating of the workpiece.

The locking device can be adjusted to obtain the height and pressure desired by a threaded shaft and locknut.

The heavy-duty spring and the two main parts of the locking head are held together by two or more long screws or peened rods.

Joseph Terran, Jackson Heights, N. Y.



Rugged Drill Fixture Indexes Smoothly

A rugged universal drilling fixture can find a place in any shop. The index base shown in the illustration is just that kind of tool. This base was designed to fill a need for an accurate indexing mechanism that could be used on several jobs by merely interchanging the part-holding fixture.

The spindle is mounted on Timken roller bearings of standard (class 3) accuracy which, when properly mounted and preloaded, give a maximum runout of only 0.0003-in. This is sufficiently accurate for practically every job in the shop. The bearings not only provide accuracy, but make the spindle easy to turn even when used with large parts.

The radial index location is accomplished by a universal shot-pin assembly which locates in bushings pressed into the part-holding fixture. This allows the base to be used on any angular index, either equal or unequal.

The part-holding fixture is located on the base spindle by a ground pilot, and is secured with four ½-in. screws. The top of the base is machined, keyed, and tapped to allow mounting the bushing-holding bracket. This same base can be used to drill holes at an angle to the surface by adding a proper angular riser under the base.

As can be seen in the drawing, the base is entirely of welded construction, eliminating patterns and castings. When all parts have been welded together, the entire unit should be given a stress-relief treatment before machining.

Bennie Lee, Indianapolis, Ind

Templets Made Quickly From Plastic

There is often a need for a quickly-made templet in the shop, particularly for checking or locating castings, or matching impressions in die work. Making a templet from metal is a time-consuming job, when involute contours are required, and is often unnecessary.

Where strict durability is not essential, we produce our templets from sheet acetate about 0.020-in. thick. This is a thin plastic material available at hardware or mill supply houses.

The templet is made by laying out the contours on the acetate. A sharp scriber is used in tracing the lines with a few thousandths penetration. If the contours of a sample part are to be copied, the part is traced directly onto the plastic.

Flexing of the material will cause the blank to pop right out. A little dressing of the edges with a needle file will take care of any remaining burrs.

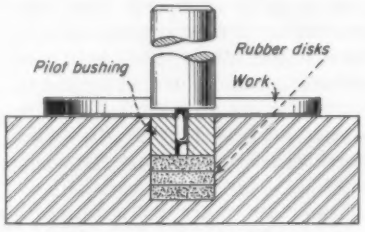
Donald Zuerl, Fulton, Missouri

Pilot Bushing Guides Punch

While we were doing some experimental work it was necessary to produce a ½-in. hole in several thin metal parts used for meter backs. It was important that the location of the holes be accurate, and that they be round with clean edges.

Drilling them to full size was tried, but found unsatisfactory. Instead, a simple punch block with a guided punch was made and used.

The punch, made from drill rod, has a body of ½-in. dia and a concentric pilot turned to No. 10 drill size. The block, after it was squared, was drilled and reamed to receive the punch, or the hole may be bored in a lathe to the required size. The hole should be



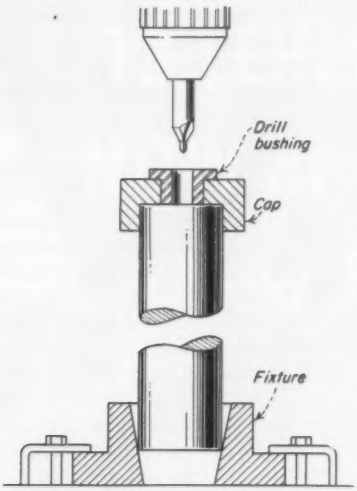
finished in a flat bottom to properly seat a few rubber ejector discs.

A pilot bushing was inserted in the punch block on top of the rubber discs. Its OD is a sliding fit in the block, and its center hole is a couple of thousandths larger than the punch pilot.

The work was prepared by carefully laying out the locations of the holes and drilled with a No. 10 drill. Then it was placed on the block with the punch-pilot through the work and into the guide bushing.

One sharp blow with a hammer on the punch is usually enough to cut a clean round hole without distorting the work.

C H Willey, Penacook, NH



Fixture Holds Shaft For Center-Drilling

Much of the turning in our shop is done between centers. Because most of this work is on short shafts, we devised a center-drilling process having some advantages of mass-production. There is also less drill breakage and no lathe is tied up for the drilling.

To do this job, we made a series of drill-bushing caps, one to suit each dia shaft. They are made of CRS, and are concentrically turned to take a drill bushing with a hole to match the body size of the center drill.

The fixture is a block with a tapered hole for locating and gripping the shafts. The variation of diameters provided by the taper affords seating of many dia shafts.

To set up the fixture for operation, the height of the drillpress table should first be determined, then the table should be positioned and locked. The fixture is then placed directly in line with the spindle and clamped to the table.

With a center drill in the chuck, a drill-bushing cap is placed on one end of a shaft. The other end of the shaft is put into the tapered hole of the fixture, and the center drill is introduced into the drill bushing. The pressure applied causes the taper to grip the shaft while it is being drilled.

Thus, a center hole perfectly in line with the axis of the shaft is quickly and safely drilled.

Federico Strasser, Santiago, Chile

Hexagonal Wrench Loosens Drill Chuck

We sometimes have to remove the screwed-on chuck from our electric hand drill to allow us to use the drill on other applications. This used to be difficult to do without causing some damage to the chuck. Removal is made easier by employing a hexagonal key wrench. With the short end of the wrench solidly tightened in the chuck, the long end is given a sharp blow with a hammer in a counter-clockwise direction.

The torque created will usually jar loose the most stubbornly jammed chuck.

Boris Metoff, Irving, Texas

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For the best PRACTICAL IDEA

IN THE DECEMBER 3, 1956 ISSUE

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An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

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REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author — every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

Two-In-One Press Is Versatile

We had only an arbor press, and at times its capacity was too small for our needs. So out of necessity was born the two-in-one press illustrated.

A frame was welded together from heavy channel iron. Carriage is also channel iron, adjustable up and down, and extending out at one end to support work for the arbor press. The arbor press has been altered by cutting its frame, and has by welds and bolts been secured to the end channel. This solved our first problem, that of capacity in the arbor press. Now we could use it to remove, or press in, armature shafts not requiring tremendous pressure.

Other times when more pressure is needed we turn to our hydraulic ram mounted in the center of the frame. This gives us several tons of pressure, enough for our requirements.

The ram is not confined to the frame, but can easily be detached and used elsewhere in the shop or on the road.

Harry Miller, Sarasota, Fla.

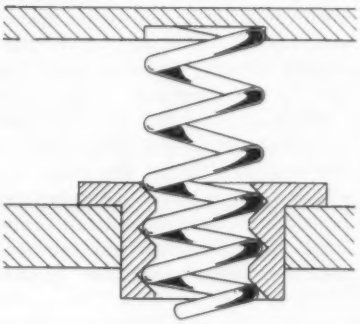
Threaded Bushing Controls Spring Pressure

We do a considerable amount of experimental die work in our shop. In the process of building these dies it sometimes happens that spring pressure is not known, but has to be found.

To get away from the old cut-and-try method, we designed the threaded bushing shown. It enables us to decrease or increase pressure as it is found necessary.

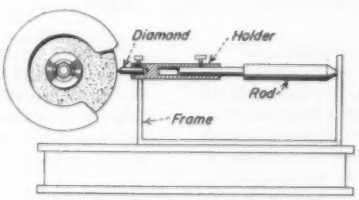
Before we started using our adjustable spring-bushing, we'd have to cut the springs overly long. It was then a matter of trying the spring, cutting off, and trying again until the proper pressure was reached. However, there was always the danger of cutting off too much, and the whole process had to start over.

With the bushing all this is eliminated. The adjustments are made simply by turning the spring in the bushing in either direction to increase or decrease the pressure.



The bushing is easy to make. A thread, whose major dia corresponds to the OD of the spring, is cut in the bore, but with a pitch smaller than that of the spring when normally compressed. The outside is machined with a flange for contact with the pressure plate.

Federico Strasser, Santiago, Chile



Telescoping Holder Allows Large-Radius Wheel Dressing

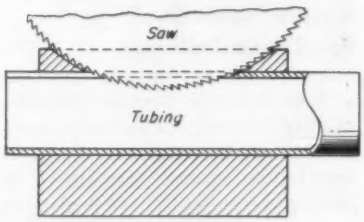
We had some form grinding to do but were momentarily handicapped because the radius required was far beyond the scope of our commercial dresser. The large concave radius necessary was easily produced with the telescoping holder shown.

This idea can also be applied if it should become necessary to dress the periphery of the wheel in a convex radius. To do this, an adapter can be secured to the end holder to hook it around to the opposite edge of the wheel.

The frame of the fixture is bent up from flat stock ¼ in. thick. It can also be made in sections, welded or screwed together, if heavier construction is preferred. Gussets may be used in the light frame.

A substantial center-punch mark is enough in which to pivot the point of the rod. The other end of the frame is squared off and smoothed to provide a proper rest for the diamond-carrying holder.

Ted Hilger, Andale, Kansas



Slitting Fixture Guides Thin-Wall Tubing

I was given the job of slitting a number of thin-wall tubes some time ago. They were 1 in. in dia, and 20 ft. long, which made them impractical for conventional strapping to the machine table.

The fixture I devised to support and guide the work was easy to make and helped me finish the job in short order.

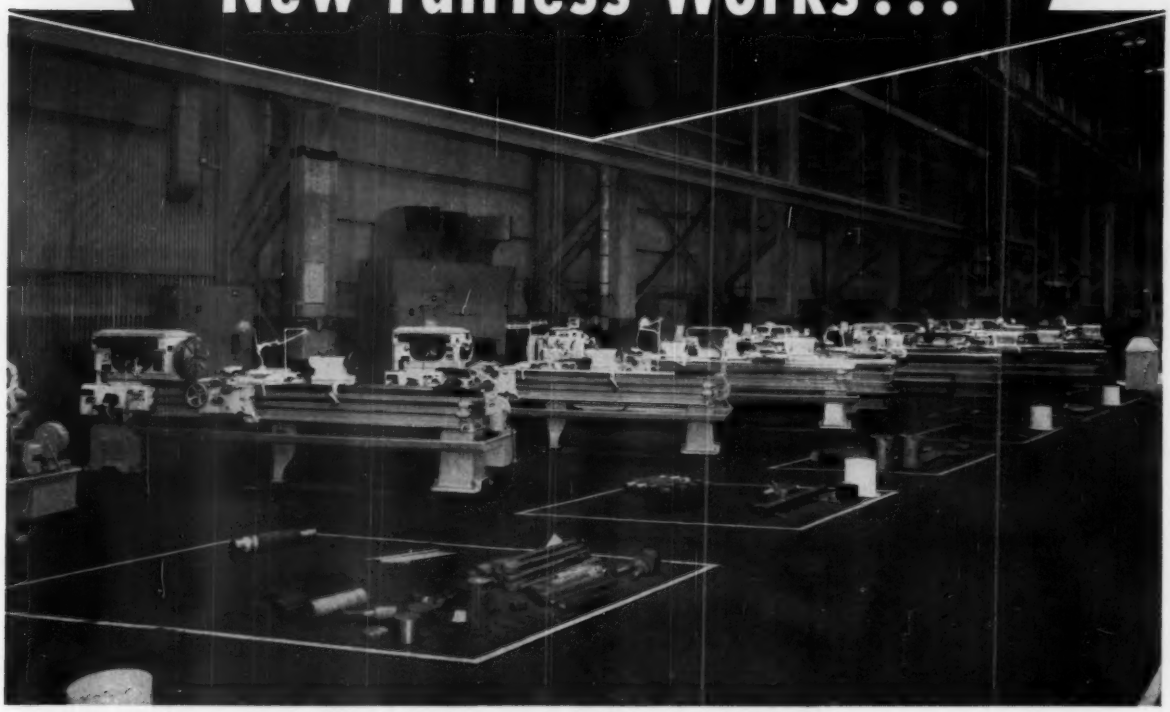
A 3-in. length of 2x2-in. cold-rolled steel was bored through its 3-in. length to receive the tubing. Clearance was generous to allow for free passage of the tubing with its variations in diameters and roundness.

The fixture was strapped to the table of a horizontal milling machine with the bore parallel to the T-slots. With a 1/32-in. by 5-in. dia slitting saw on the arbor, I raised the table until the saw penetrated ¼ in. into the center of the bore.

When this was accomplished, the speed of the cutter was increased to twice its rated cutting speed. This allowed me to push the tubing through the fixture, slitting it without any trouble.

Herbert Jaffe, Brooklyn, NY

13 LEHMANN Engine Lathes NOW at work in U. S. Steel's New Fairless Works...



The largest integrated steel mill to be built at one time uses LEHMANN Lathes in its modern maintenance shops!

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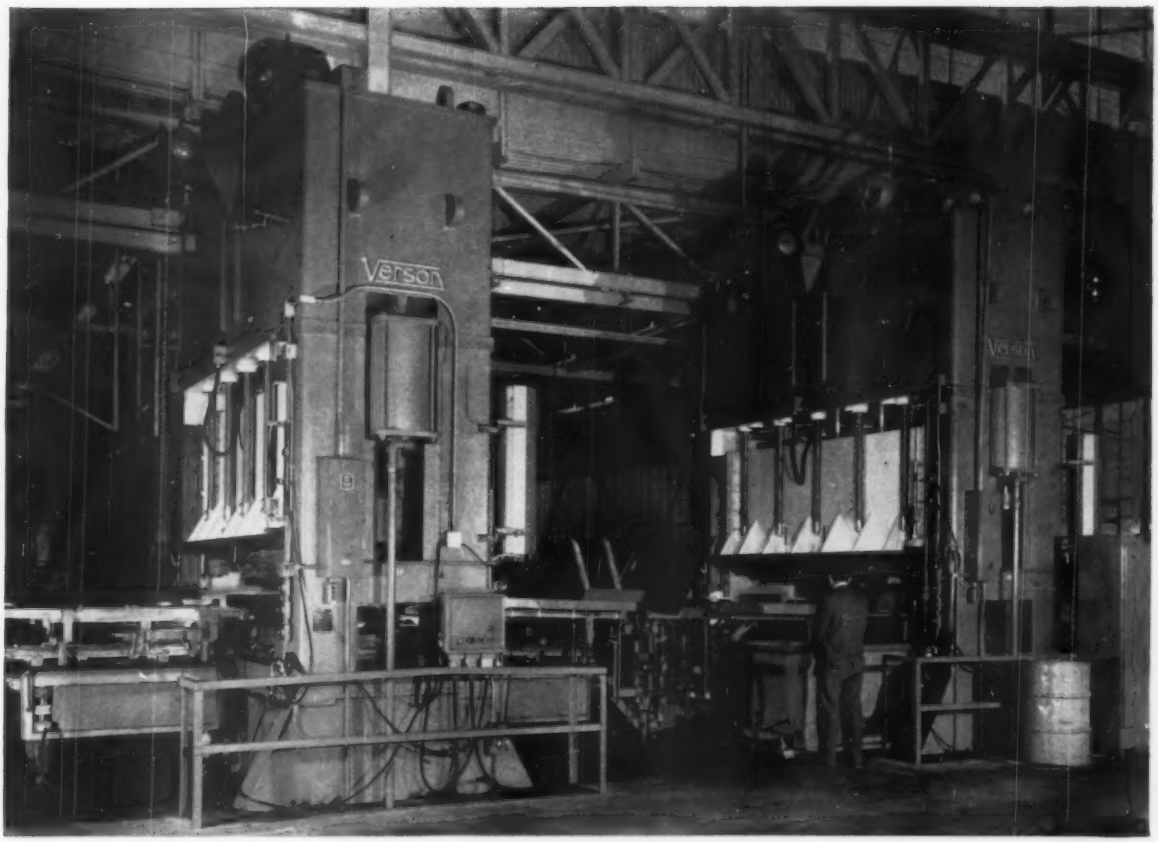

Two 400 ton Verson Presses

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Tolerances and Limits . . VII

Positional Tolerance Related to Feature Size. Because all features have allowable variations of size, it must be clear at what condition of size the true-position tolerance applies.

Because the least favorable assembly relationship between the mating parts exists when the mating parts are at their maximum-material condition, it is usually necessary that the true-position tolerance apply only to this maximum-material condition.

Maximum-material condition of a part is that condition where the part contains the maximum material, e.g., minimum hole size and maximum shaft size.

Where the requirements of the maximum-material condition(MMC) apply, it shall be stated:

1. By the use of a general note; or
2. By adding the abbreviation "MMC" to each applicable size specification; or
3. By suitable coverage in a specification which is referred on the drawing.

Where maximum-material condition is not used, the true position tolerance applies regardless of feature size. If it is desired to emphasize that the true-position tolerance applies regardless of feature size, a phrase such as the following may be added to the drawing note: "REGARDLESSS OF FEATURE SIZE." For example:

(a) 6 HOLES LOCATED AT TRUE POSITION WITHIN 0.010 DIA REGARDLESS OF HOLE SIZE.

(b) 6 HOLES LOCATED WITHIN 0.005 R OF TRUE POSITION REGARDLESS OF HOLE SIZE.

"Zone" Tolerances for Contours. A "zone" tolerance may be given where a uniform amount of variation can be permitted along a contour. The drawing is constructed to show the desired contour fully defined by dimensions without tolerances. Information must be included specifying that the general tolerances do not apply to the di-

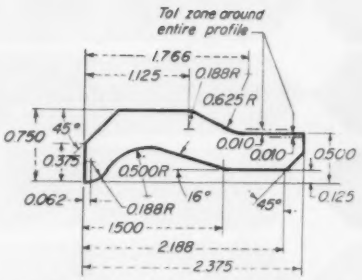


FIG. 31—Zone tolerances around an entire contour

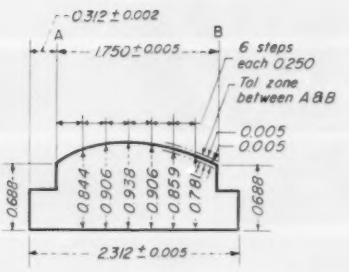


FIG. 32—A zone tolerance between two points on a contour

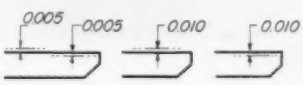
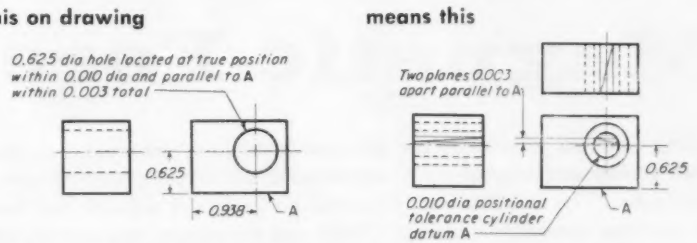
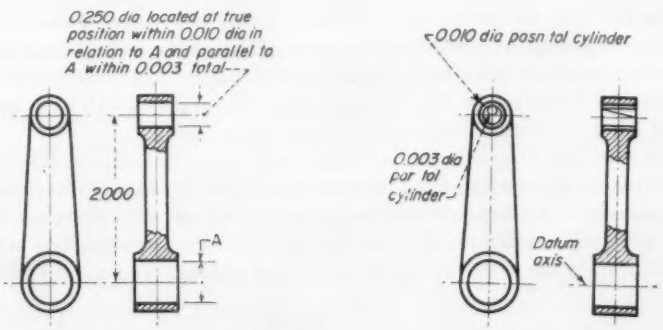


FIG. 33—Bilateral and unilateral zone tolerances


This on drawing
means this
0.625 dia hole located at true position within 0.010 dia and parallel to A within 0.003 total
0.625
0.938
A
Two planes 0.003 apart parallel to A
0.625
0.010 dia positional tolerance cylinder datum A
A

FIGS. 34 and 34a—Specifying a hole that must be parallel with a flat surface


0.250 dia located at true position within 0.010 dia in relation to A and parallel to A within 0.003 total
2.000
A
0.010 dia posn tol cylinder
0.003 dia par tol cylinder
Datum axis

FIGS. 35 and 35a—Specifying that a hole must be located from and be parallel to another hole

Now – weld these critical metals at production rates

Fine silver contacts to	Bronze, Tin plated brass, Cadmium plated brass, Brass, Copper, Olympic bronze, Silicon bronze.
Powdered molded silver contacts to	Brass, Copper
Silver tungsten contacts to	Copper
Copper tungsten contacts to	Copper
Brass to	Mild steel, Stainless steel
Cast iron to	Mild steel
Tungsten contacts to	Spring steel, Low carbon steel
56S Aluminum multiple cross wire to	56S Aluminum multiple cross wire

New Precision Magnetic Force Welder

Many materials, previously thought unweldable, are now welded at production rates with quality and consistency. Costly brazing and riveting methods are completely eliminated! The new Precision Magnetic Force Welder is faster and more economical. It improves consistency, strength, finish and electrical characteristics of the bond. Expensive bimetals or composites are no longer needed to join electrical contacts. Since there is little or no expulsion, further machining is rarely needed. *Costs are reduced up to 50%.*

The Precision Magnetic Force Welder – a new form of resistance welding – substitutes highly responsive *magnetic* force in place of hydraulic or pneumatic force. This minimizes electrode pick-up, gives longer electrode life and reduces need for face dressing of electrodes. Users report that several million welds per month have been made without weld failure and with minimum electrode maintenance!

The Precision Magnetic Force Welder can be readily adapted for automatic parts handling, to fit in with your other manufacturing processes. Wherever required, our engineers will develop new and special tooling to suit your exact need – with performance and satisfaction guaranteed. Your nearest Precision representative will be happy to assist you. Write or call us for his name and address. And ask for Bulletin No. MF-100A

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Tolerances and Limits . . VIII

mensions establishing the desired contour. At a conspicuous place along the contour, one or two phantom lines are drawn with dimension lines and arrowheads to indicate the location of the tolerance zone. The value of the tolerance is given by note. See Figs 31 and 32. (For drawing clarity, the distance between the contour and the phantom lines may be greater than its scale value.) If some limits on a drawing are expressed by a zone tolerance and others by a general tolerance, the extent of the zone tolerance must be clearly indicated, as in Fig 32. The zone may be symmetrical around the desired contour, or it may be entirely plus or entirely minus. See Fig 33.

Relation of Positional Tolerances to other Tolerances of Form. Fig 34 illustrates expressions for specifying that a hole must be held parallel with a flat surface more closely than its positional tolerance alone would indicate. The meaning of the combined expressions is given by Fig 34a. In a similar manner, Fig 35 illustrates expressions to require that a hole must be located from and parallel with another hole more closely than the positional tolerance indicates. Fig 35a illustrates the intended meaning.

The illustrations of meanings are examples only, each indicating one of the possible positions of an axis within a tolerance zone. Limits may be placed on other deviations (squareness, etc.) from intended position, by adapting other form-tolerance expressions. These additions to positional tolerances are necessary only where other characteristics must be held more closely than position.

Relations between Size Tolerances, Tolerances of Form, and Surface Roughness. In general, the ranges of tolerances on size, tolerances of form, and specifications of surface roughness overlap one another considerably, so that the three kinds of variation cannot be separated merely on the basis of numerical values.

For a particular part, however, variation in form must not exceed the size tolerance, and therefore need not be stated unless it is smaller. For example, if the size tolerance is ±0.005, it would be necessary to state a tolerance of form smaller than 0.010 in.

Similarly, if the tolerance for flatness on a given surface, for instance, is 0.001, surface roughness smoother than 1000 mu-in. should be specified.

When tolerances of form are not specified on a part drawing, it is commonly understood that an actual part will be acceptable if it is within the dimensional limits given, regardless of form variations. Fig 36 illustrates typical extreme errors of form that would be acceptable under this interpretation. (This does not apply to fabricated materials such as bars, sheets, tubing, etc. There, established industry standards prescribe straightness, flatness, and other conditions. When tolerances of form are not given on drawings of parts made from these materials, industry standards for the materials govern the surfaces that are not machined.)

Positioning Angular Surfaces. An angular surface may be located by

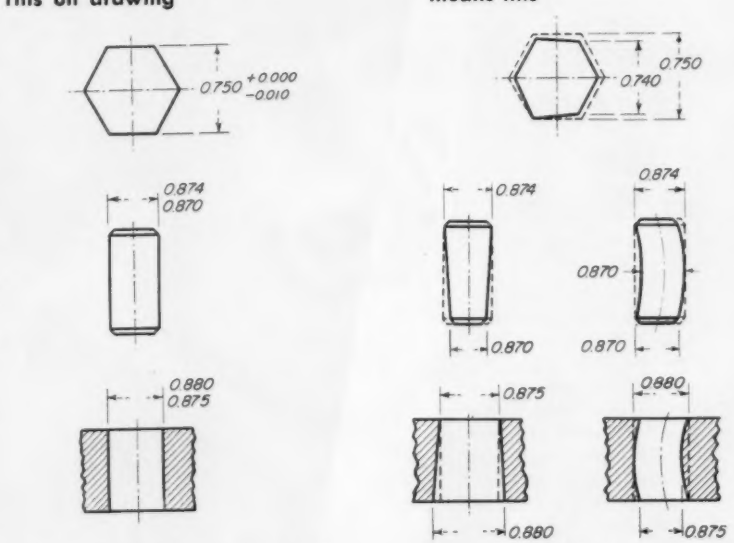


FIG. 36—These sketches show the tolerance zone or boundary within which form may vary when no tolerance of form is given

WHAT'S BEHIND THIS PICTURE ?

Electric arc furnaces represent the greatest degree of refinement of any steel-producing method. The more rigid metallurgical control possible in the electric furnace assures the highest, most uniform quality in every heat. The versatility of the electric furnace makes possible the production of many steels required to serve a diversified market. The electric furnace has made the Copperweld trademark a symbol of the finest steels you can buy.

ARISTOLOY STEELS

COPPERWELD STEEL COMPANY • STEEL DIVISION • WARREN, OHIO

EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

Tolerances and Limits . . IX

a combination of linear dimensions and an angle, or by linear dimensions alone. Each arrangement of dimensions and tolerances has the effect of specifying a particular tolerance "zone" within which the surface must lie. The shape and extent of the zone thus specified depends on the dimensioning method chosen, and on the way tolerances are arranged around the locating dimensions. If an angular surface is located by a combination of linear and polar coordinates, as in Fig 37, the surface must lie between planes represented by the tolerance zone shown. The tolerance "zone" will be wider as the distance from the apex of the angle increases.

In order to avoid the accumulation of tolerances, the basic angle tolerancing method illustrated in Fig 38 can be used. No specific tolerance is placed on the angle which is specified as "BASIC." This indicates that the actual variation permitted to the angle is defined by the tolerances on the two linear dimensions. These define a tolerance zone within parallel boundaries and the accuracy of the angle must be such that no part of the resulting surface exceeds these boundaries.

(If the angular tolerance is expressed by a tolerance of form, the angle can be given without loss of precision. See Fig 27 for an example of a tolerance of form on angularity.)

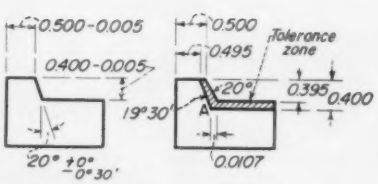


FIG. 37—Cumulative angular tolerancing

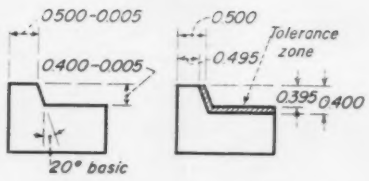


FIG. 38—Basic angle tolerancing

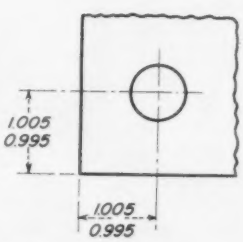


FIG. 39—Direct tolerances

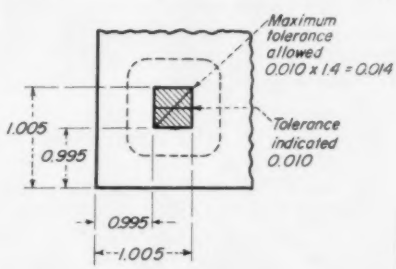


FIG. 40—Square tolerance zone

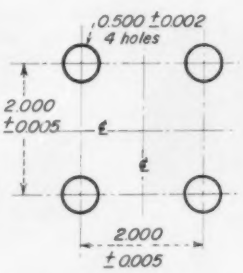


FIG. 41—Location of 4 holes by direct tolerances

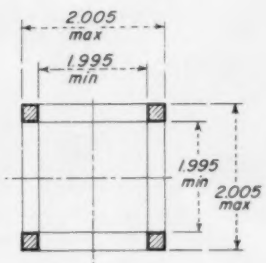


FIG. 42—Tolerance zones for holes in Fig 41

Appendix
TRUE POSITION

True-position dimensioning establishes locations by giving distances from datums, to locate true positions, and a tolerance within which an actual location may vary from its "true position" (theoretically exact location).

Under another practice in the past, locations are given on drawings by means of rectangular or polar coordinates, each with its own tolerance. Direct tolerances, as shown in Fig 39, allow variation in the direction indicated by the dimension lines, which results in a square tolerance zone, as shown in Fig 40. Since variation of the actual location may occur anywhere in the square, the maximum allowable variation from the desired location occurs at 45° from the horizontal or vertical direction in which the tolerances are indicated, and therefore, is greater than indicated by tolerances on dimensions.

For a group of holes located with respect to each other, as in Fig 41, one interpretation is shown in Fig 42.

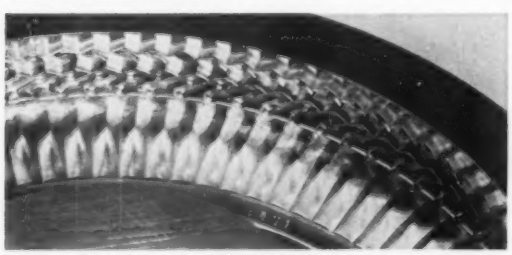
STEEL MACHINING CASE STUDY

How $30 worth of steel plate took the risk out of a $4000 machining job!

There's a quick, sure way to select exactly the right steel—whatever your particular application. Draw on the wide experience of Ryerson specialists who are working with hundreds of other steel users on similar problems every day. The right steel can make a big difference—can mean a better product, lower production costs—as the following case study illustrates.

THE PROBLEM—Central Mold & Machine Company of Akron contracted to make a chrome-plated mold for producing an exact duplicate, in miniature, of Firestone's new Supreme tubeless tire.

Only a very small piece of plate steel was needed for the job—but the steel had to be extraordinarily clean and sound. Hundreds of hours of machining time were to be "invested" in it and some of the tiny lands that formed the unusually intricate tread design were only .015 of an inch thick!



A close up of the mold for the 6" tire showing intricate machining with lands only .015" thick.

SOLUTION—Working with a Ryerson representative, Central Mold & Machine selected New E-Z-Cut plate for the job. Because this Ryerson leaded plate steel is remarkably clean and free of excessive stringers, even the finest lands of the mold were sharp and true. Because New E-Z-Cut machines as much as 30% faster than mild steel plate, the difficult machining job was completed in minimum time. And because New E-Z-Cut machines to a high finish and polishes readily, the mold was very satisfactorily prepared for plating, at low cost.

If a better quality free-machining plate had been available at any price it would have been used here because, at almost any price, the cost of the steel would be only a tiny fraction of the cost of the finished mold. New E-Z-Cut (approximately $30.00 worth) was used because it took the steel risk out of a $4000 machining job.

Whatever your steel problem, it will pay you to check with Ryerson specialists and draw on Ryerson stocks of highest quality, special purpose steels.

WE CAN SHEAR OR FLAME CUT TO YOUR SPECIFICATIONS FROM LARGE PLATES IN STOCK

All New E-Z-Cut plates are 84" wide, and may be sheared or flame cut to your specifications. We have both single torch equipment and multiple-torch electric eye machines for flame-cutting a single special shape or many duplicates. Please call or send in your drawings for prompt quotation.

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Talking Shop . . .

A Word For It

YEARS ago, a brilliant Japanese named Hayakawa taught us the dangers that lie hidden in words that have different meanings to different people. Peter Trippe, our London Staff Correspondent, who has been writing our series of "Reports from Russia," learned the same thing about the hazards of working through an interpreter.

While talking with the staff of one plant, Peter was surprised to hear the interpreter translate a comment: "Your machine tool industry has a long beard."

This struck Peter as a trifle harsh and he took the offensive by retorting, "I've seen some pretty old machines here, come to that." When this was translated it was greeted with blank looks. Finally the matter was straightened out. The Russians had meant not to insult, but to praise—to say that the British machine tool industry was venerable, with a lengthy tradition.

Concluded Peter from this experience: "It is easy to see how goodwill could be damaged innocently by being too sensitive or by assuming that a remark has passed unscathed through interpretation. An idiomatic phrase in one language may be an insult in another."

Students Talk Back

FREE-FLOWING parties and senior-year salaries do not impress college students wooed by industry. These were points picked up by Kaiser Aluminum in an informal session with 40 trainees at two plants near Spokane. Students feel that a company need not party its prospects to attract them if it has a genuine program to offer. The average student interviewed is already a veteran of a dozen other interviews and is quick to spot trick questions. Kaiser interviewers have only the student's own application blank on the desk. They report that this seems to impress students, who feel they get personal attention rather than becoming a series of checks on a chart. (For five minutes after each interview, the Kaiser interviewer fills out the form.) Good relations with instructors are important; many students mentioned good classroom reports influenced their choice.

Metal Identification

AN instrument is reported from London that will identify non-ferrous alloys by measuring their electrical resistance. Developed by Solatron Electronic Group, Thames Ditton, Surrey, England, the portable instrument measures electrical resistivity in micro-ohms per centimeter cube. Results are read from a calibrated dial that will handle metals between 1.0 and 28.0 micro-ohms per cm^3. The instrument requires a fairly smooth surface (not necessarily flat) with a width of 0.75 in. in a section that is at least 0.02 in. thick.

The Downward Look

INTERESTING note on Ford's forthcoming Edsel nameplate: styling experts looked down on a parking lot from the top of a 10-story building, found all cars looked the same, promptly styled the Edsel so that it will be easily recognizable from that height. Spare tire on the roof, maybe?

Bolt Tightening

It is almost impossible to get a nut too tight—if strength of the joint is your only concern—according to the people at Russell, Burdsall & Ward Bolt and Nut Co. If the bolt is the right one for the application, the pre-load tension will keep the nut tight so long as the external load does not exceed this pre-load. Overtightening will stretch the bolt permanently, deforming the threads. This doesn't affect strength, though it does mean the bolt can't be reused, so when the assembly is a permanent one, no harm is done.

Plastics Invade

Plastics are really getting around. As reported at the 12th annual technical and management conference of Society of the Plastics Industry, held in Chicago, Feb 5, 6, and 7, reinforced plastics are now being used for: Redstone missile skin panels, a 54-ft yacht hull, truck panel bodies, buses, ambulances, trailers, small cars, glider fuselages, an aerial-railway cab, a welder's shield, and wing tips. A smoke stack for waste gases, and gearbox plates with molded-in bearings are other applications.

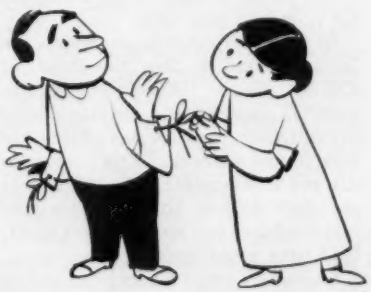
Nuclear Batteries

As an indication of how far the research on atomic energy has gone, two different nuclear batteries were announced last month. The first was developed by Patterson Moos Div of Universal Winding Co. It converts nuclear energy directly into electrical energy (they don't say how) at current ratings of 5 to 5000 micromicroamperes and equilibrium voltages of 10,000 volts. The battery is incorporated in a power pack containing a capacitor, charged by the battery, that delivers pulses of 75 to 750 volts. The power packs range from less than one to two cubic inches in size.

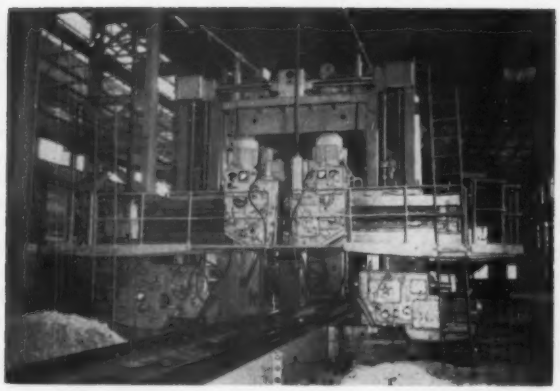
The second battery, about the size of the head of a thumb tack, is the work of Elgin Watch and Walter Kidde. Beta transmissions from an oxide of Promethium 147 are converted to light by a finely divided phosphor. This light is converted to electricity by two or more photocells. Output is 20 microwatts at ¼ to 1 volt. Ultimate objective: hearing aids, miniature radios, and—eventually—wrist watches.

Missing Link

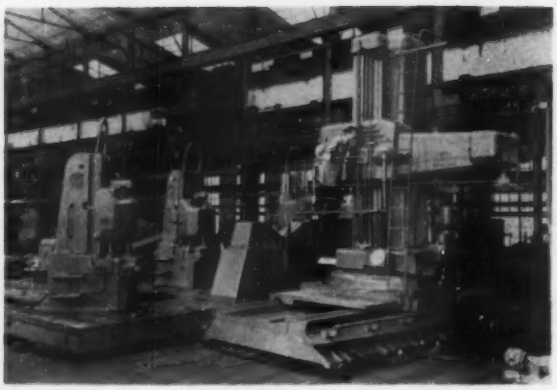
A serious shortage of cuff-links has arisen in Czechoslovakia. It seems that responsibility for the manufacture of cuff-links was not specified in the five-year plan now being implemented. It was thought that the Ministry of Domestic Trade had the matter in hand, but officials there considered that the responsibility for cuff-link production was the Ministry of Industry's job. Unfortunately, in stating this decision, they did not state whether they meant the Ministry of Heavy Industry or the Ministry of Light Industry. So neither took any action. Looks like the Czechs will now have to roll up their sleeves.



FOREIGN REPORT ...No. 6 on Russia



New plano-miller . . .
is shown here being installed at Razan (the plant that makes anywhere between 2000 and 4000 heavy-duty lathes a year). It was built by Gorki Works



Bay at the Sverdlov plant . . .
which specializes in making outsize special machines. Under construction is a 110-ton machine for boring hydroelectric turbine buckets

All Major Russian Machine Tool

An eyewitness report by
Peter Trippe
London Staff Editor

MOSCOW—Every major Russian machine tool plant is set up to build special machines on a sizable scale, as well as general-purpose tools. Such plants are organized into two distinct and separate divisions, each with its own staff. This concept is believed to be different from that of any other major machine tool building country.

There are some machine tool builders in the United States and in Britain who build standard machines and specials in the same factory, but only in Russia are all major machine tool plants dual-purpose.

It is this dual-building concept, the Russians say, that is behind the Soviet Union's ability to engineer, construct and equip a complete machine tool plant in 18 months or less —and to build the special machines for it in half that time.

In previous *Reports on Russia* we have discussed the functions of ENIMS, Soviet Russia's overall industrial planning and developmental organization. And we have discussed how Soviet plant-building principles are put into operation. In this report we shall discuss how intricate special machines are built to meet short-lead time plant opening deadlines.

Obviously, once a plant has gotten through the drawing-board stage much of the 18 months allowed for getting it into production has already elapsed. That leaves an average of nine months to build the special machines it needs, and you would expect to find huge plants planned and set up to do nothing but produce special machines in specific fields—say one making special lathes for Russia's automated ball bearing lines, another making special grinders, and a third manufacturing multi-spindle plano-millers such as those used in some of Russia's big machine tool plants.

Planning "Almost Casual"

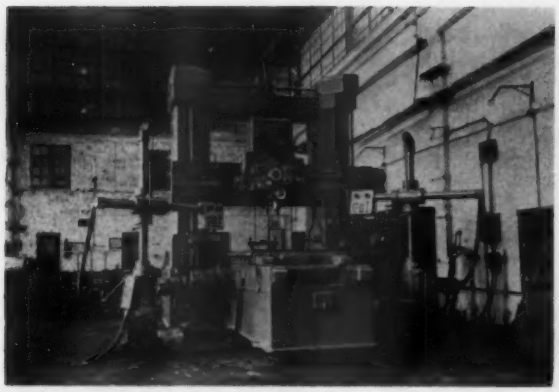
Nothing could be farther from the truth. Overall planning for production machines in Russia seems almost casual—the crux of such planning lies in the ability of every major machine tool plant in the USSR to make specials in addition to its standard machine products. The specials are usually allied to the plant's standard lines, i.e., special grinding machines are produced in standard grinding machine plants.

Generally, Russia's metalworking industry is organized this way: each plant has a standard machine or range of machines that it can make on a production basis, plus facilities to build specials, semi-specials and machines needed in relatively small quantities. There are even a few plants that have no real standard product, but which turn out a wide variety of machines to user specification. Such machines are nearly always standard types re-tailored to fit a particular job.

This system of distributing the manufacture of special machine tools throughout the entire industry seems to work very well, but it is possible only because rigid overall control of the plan is maintained, and because rigidly enforced standardization allows a project to be carried out without hindrance from manufacturers' variations.

That doesn't mean that makers of machine tools are limited to building blindly on someone else's designs, or that users are restricted to a narrow choice of specials. On the contrary, many machines are designed and built right in the same plant, and users have a wide choice of available machines, plus the right to initiate special designs and techniques if the line seems to warrant it and known methods are inadequate.

Overall control of machine tool standardization rests with ENIMS, Russia's machinery research and development organization. This has resulted in a conception of standardization that insures that table or transfer heights, for example, will follow rigid standard specifications. That makes it easier to design a standard range of bases, columns,



This is the "Leningrad SIP" . . .
the machine that so closely resembles its West European counterpart that even the Sverdlov plant manager calls it the "Leningrad SIP"!

This is just one of many types . . .
of huge special and standard boring mills under construction at Leningrad's Sverdlov plant for other machine tool plants throughout Russia

Plants Make Specials, Too

rotary indexing mechanisms, and so on. Heads are also standardized, not only those for multi-drilling, but heads for much larger units such as those on plano-millers.

The basic idea is not to limit the variety of useful machines or combinations of machines, but to cut out unnecessary machines and duplication of prototype work. Because commercial competition is non-existent in Russia, no plant keeps design or development secrets from another. Russia's industrial attitude seems to be that free exchange of information is essential in cases where several groups are thinking along the same lines. The use of highly standardized components and well-tried methods makes for effective application of the tested work of other prototype designers.

Apart from the overall control vested in ENIMS, where there is considerable freedom of design, a plant setting up a new line frequently designs and builds many of its own special machines. Even those plants specializing in very high quantity production of machine tools are expected to provide their quota of specials and small-run tools.

At Krasnoi Proletarii in Moscow, where 12,000 production lathes are turned out a year, facilities for making specials occupy a good-sized part of the plant and employ three-fourths or more of the total workforce of 4000. Krasnoi Proletarii not only built many machines for its conveyorized lathe line, it designed and built special duplex lathes for turning taper races in the automated Moscow bearing plant. The same shop, incidentally, is turning out a crankshaft grinder on a production basis, a special machine for turning the airfoil section of gas-turbine blade, vertical rotary transfer machines with both 8 and 6 stations, plus a variety of machine tools for internal combustion engine plants, such as crankshaft grinders, lathes, and a machine for profiling webs.

Leadscrew Correction

Krasnoi Proletarii has also developed its own method of correction for production of precision leadscrews. It's said to achieve an accuracy of 0.000060 in. per pitch, with error over 11.81 in. not exceeding 0.000087 in. Cumulative error over a length of 8.2 ft is about 0.000874 in. The method is used primarily on a lathe that performs finishing operations on lead screws, but it can also be used in inspection and for leadscrew correcting.

Another of Krasnoi Proletarii's own designs is a camshaft-turning machine that maintains a true cutting angle throughout the lobe by continuous adjustment in relation to rise of the cam. The leadscrew correction method and the true-cutting technique are the only two developments about which the Russians are reticent to give details.

I was invited, almost ordered, to look at Krasnoi Proletarii's laboratory and development section, which in any nation where the free enterprise system exists would be kept under lock and key in most cases as far as the press or visitors are concerned.

Of particular interest was a program-controlled lathe for turning out stepped shafts which can carry out any program to a total sequence of 10. It can cope with differences in diameter of steps up to 0.39 in. achieving tolerances within 0.0006 in. on length and 0.002 in. on dia. Where more than one pass is required, the increase of cut is set in automatically as part of the program at the beginning of each cycle.

Also shown to me was a hydrocopying device intended as an accessory to operations where copying is required only occasionally. The machine has a cam plate mounted on the front, and particular attention has been paid to easy mounting and removal of the attachment—only 8 minutes is needed to remove the standard tool post and put the attachment in its place.

Russia's machine tool plant at Odessa turns out some 2000 radial drilling machines a year, more than total U S annual output, and in ad-

RUSSIA (continued)

dition produces vertical honing machines in three standard sizes from 7.09 to 19.68 in. for the "automotive and allied industries." Odessa also produces seven types of horizontal and vertical borers, some with inclined heads for boring V-cylinder blocks.

Like Russia's other machine tool plants, Odessa turns out specials, too —special heads for radials, radials designed for automatic lines, superfinishing machines, and automatic storage hoppers such as those employed on the Moscow automatic bearing lines.

Standard units are used wherever possible in the machine tools produced at Odessa—but it's not always possible. For example, the Odessa people have had a good deal of trouble in manufacturing equipment for cylinder block lines—table heights must vary with the blocks being made. But aside from that and a few other diversions from the norm, standardization has been carried as far as possible to simplify machine tool building and to make it more economical.

One notable unit in Odessa's large experimental shop was an outsize honing machine, so big it had to be assembled in a pit. The 28-ft-high machine has a honing capacity of 19 in. dia, a stroke of 9.2 ft, and a spindle speed of 420 rpm. Also under construction in the same shop is a smaller model (47.25 maximum stroke, 400 rpm spindle speed, 5-minute operating cycle).

Heavy Radials at Odessa

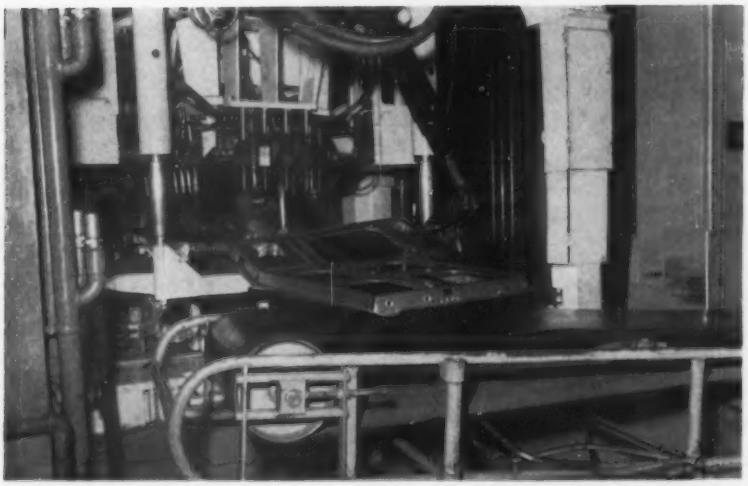
Also under construction at Odessa are several heavy transportable radial drills. One such has pushbutton traverse along the bed, offers preselection of speeds, using a hydraulic change, allowing 20 to 900 rpm in 12 steps. It's designed for holes from 0.629 to 1.97 in., weighs 7.1 tons, can work in any plane and at any angle, has an arm that swings through 360° on the vertical column, and a head with 90° vertical adjustment and 360° rotation. Main horizontal arm can be swung either 10° above horizontal or 30° below, using a hand wheel. Machine has 9 spindle speeds from 0 through 850 rpm. Feed box, on the head, has four feeds ranging from 0.0039 to 0.016 in. per revolution. A reversing spindle permits right or left hand rotation, and there are facilities for depth control, permitting accuracy to ±0.0039 in.

It was interesting to see at one end of the Odessa experimental shop a large planer made in Siberia. It seems that machine tools of various kinds have been made in Siberia for several years—and Siberia occupies an important place in Russia's plans for its future industries. Siberian plants are manned by volunteer workers who have the same status in the country as commandos or shock troops in wartime.

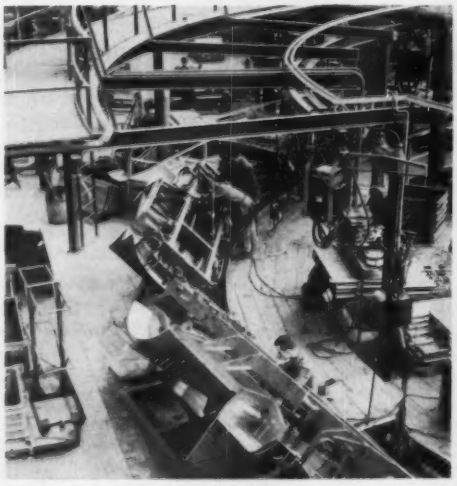
Next to the Odessa plant's experimental shop is its instrument shop, which seems to be more preoccupied with making keys and small components than with instruments as such. A third shop is given over to hydraulics. It is a long bay filled with a number of special machines in various stages of assembly or ready for test, including:

• A hydraulic, semi-automatic precision borer for tractor wheels. This duplex machine bores from opposite ends in a sequenced time cycle. Work is loaded into a fixture and hydraulically clamped, then a pushbutton starts the cycle and the workholder moves back into position between the two heads. Heads feed in and bore the diameter, then the shoulder is machined. This isn't ordinary

New Body Plant, New Methods



Automatic handling device . . .
on door fabrication line clamps parts in multiple spot-welder and then, after welding, ejects them onto belt conveyor which transports them to next operation. This is an example of the improved methods employed at Volkswagen's new Hanover delivery van and station wagon body plant. Engine and transmission components are still manufactured at Volkswagen's headquarters plant in Wolfsburg, Germany



Progressive assembly line . . .
has rollover fixtures for easy access to all parts. Assembly dollies ride on tracks, and frames are fabricated on an oval line. Floor sheets are received from a round line—work time is 25% less than stationary assembly

turning—it is an operation carried out by fine boring tools that have a radial movement imparted to them through the spindle.

• Transfer machines for automotive production include an 8-spindle cylinder borer that uses transfer rails incorporated as an integral part of the table. Working cycle is 10 minutes per block using a maximum spindle speed of 700 rpm and a feed of 0.00234 in. per rev. To avoid scoring the bored surface on withdrawal of the boring heads, the spindles stop as the head finishes the boring operation. An electrical mechanism then orients all the spindles so that the cutters are all facing in the same direction, and a small movement of the heads (0.197 in.) from left to right is imparted, relieving the cutters from the machined surface before the spindles withdraw.

The Sverdlov plant in Leningrad specializes in Keller-type copying machines and a large jig borer so like a Hydroptic that even the plant's director calls it the "Leningrad SIP"! This middle-sized (2500 employees) plant is old-fashioned, badly lit, and full of obsolete machines. Yet it still turns out good machine tools—and quickly, too.

About 20-25% of Sverdlov's output is given over to specials, including some very heavy boring machines, outsize copying machines, and machines for work on hydro-electric turbine buckets. While the need for new machine tools in this plant is urgent, practically all replacements of its obsolete U S, British and European machines are being built in Russia. It is certain the Russians would buy replacements from the West, but the embargo forbids it, so the Russians must fall back on their own resources.

Of interest at Sverdlov is the heat treatment shop, which is quite well equipped with vertical pits for nitriding spindles up to 13.12 ft, with a variety of smaller baths, and with three ovens.

In direct contrast to the rest of the plant is a new room for assembling and testing large machines under temperature-controlled conditions—it is large, light, airy and well-equipped.

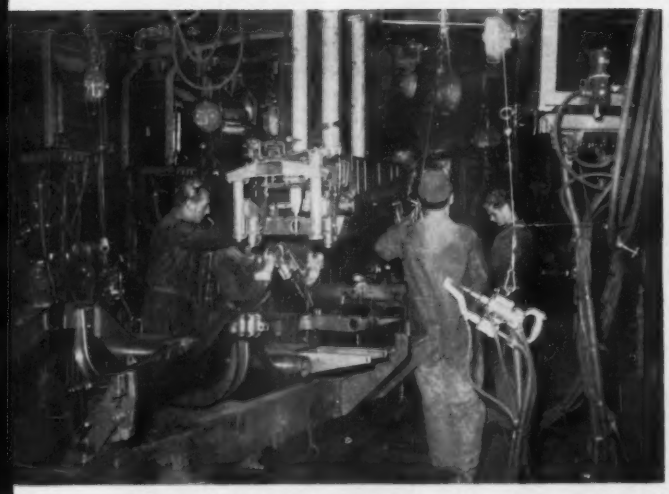
Incidentally, the plant director claims that the "Leningrad SIP" "happened simultaneously" with the actual SIP optical coordinate jig borer. He admits he saw it at the Hanover Fair, but claims Sverdlov had already completed design of its similar model. Questioned as to whether they copy well-known designs from other countries, the Russians admit that their machines have the same appearance as Western machines, but as in the case of jig borers and copy millers, they claim that these are almost "classical" designs and that it is inevitable that new models borrow something from them.

Among the specials at Sverdlov:

A heavy copy-miller with working dimensions up to 9.186 ft, and a "length from Moscow to London." Each motion has its own drive, and operation is centralized in a single lever. Pushbuttons are used only to set the motors in operation.

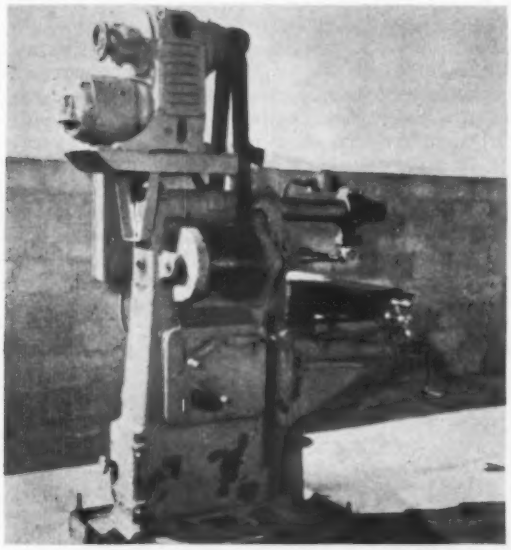
A special borer (first built in 1951) for turbine-reduction-gear casings that has a boring capacity from 16.5 to 13.2 ft dia, with a bar 13.78 in. dia and 26.25 ft long. Machine features automatic positioning on the axial plane, with the boring cutter fed out radially by means of a screw arrangement within the spindle. Feed is preset with a dial graduated in 0.00039 in. Thermo-relay and clutches provide protection against overload. Spindle drive is from a 30-kw motor.

for Germany's Volkswagen



Welding fixture suspended over frame assembly . . . is lowered on piston and engaged with assembly dolly for accurate positioning of sheet metal parts. Man on other side of line is making final weld as others install parts for next cycle

Final assembly line . . . extends length of plant. After automatic spray painting, units come here for installation of engine, transmission, wheels, and hardware. Volkswagen's new plant turns out 300 vehicles a day with 4500 workers



This is what happened to a milling machine 2750 ft from Ground Zero . . .

Milling machine, mounted on a concrete base and located behind a concrete block wall (left) was irreparably damaged by the blast and flying debris—mainly because the main column casting was already 60% cracked before the blast. This was the only machine beyond repair at test's end

"Operation Teapot": What Happens

WASHINGTON—How well do machine tools stand up under atom bombing? To find out, the Atomic Energy Commission conducted "Operation Teapot" at its Nevada test site from February through May of 1955, and it has now published the results of tests on 11 heavy-duty machine tools of varying types and sizes.

Varying Distances from Blast

This was the test setup:

- Two engine lathes and two knee-type milling machines were installed on a concrete base and behind a concrete-block wall (simulating industrial installation) 2750 feet from Ground Zero.
- One 200-ton hydraulic press was installed immediately behind a two-story brick house at 4700 feet from Ground Zero.
- Two vertical milling machines, two pressure vessels and two drying ovens were set up in Butler and Armco industrial buildings at 6800 feet from Ground Zero.
- Machines were anchored and positioned in various ways to induce damage from flying debris.
- Basic machine tool lubricating oils were also exposed to blast.

The results of the explosion:

- Damage was most severe nearest the blast (2750 ft), much less so at 4700 and 6800 ft.
- Only one machine was completely demolished, and it was subsequently discovered that the machine's subbase had been broken before the blast occurred.
- Flying debris, not blast, created the most damage to machines.
- Most vulnerable parts of machine tools are fragile external parts and controls.
- Major castings and forgings suffered no damage.
- The blast had little or no effect on lubricants.

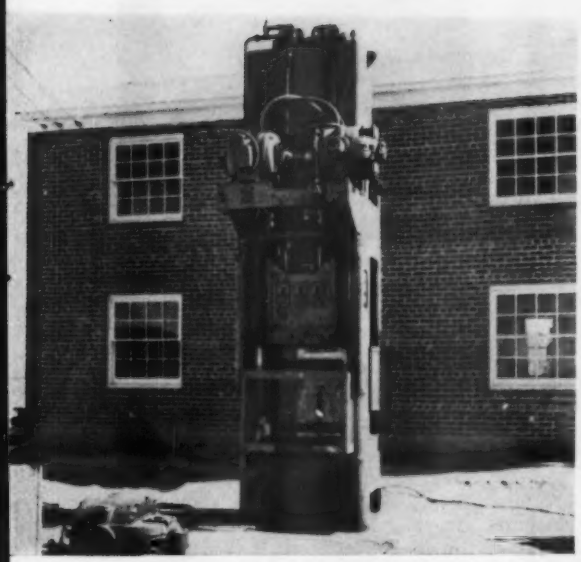
Operation Teapot, or to call it by its official name, Project 34.4, had as its objectives: (1) to find out how vulnerable machine tools are to atomic attack, (2) how well precision tool parts hold up by comparison with heavy castings and forgings, (3) should we stockpile long-lead-time machine tools for defense, (4) or would stockpiling of just critical machine tool replacement parts be sufficient, and (5) how long would it take to get a plant back into operation after an atom bombing?

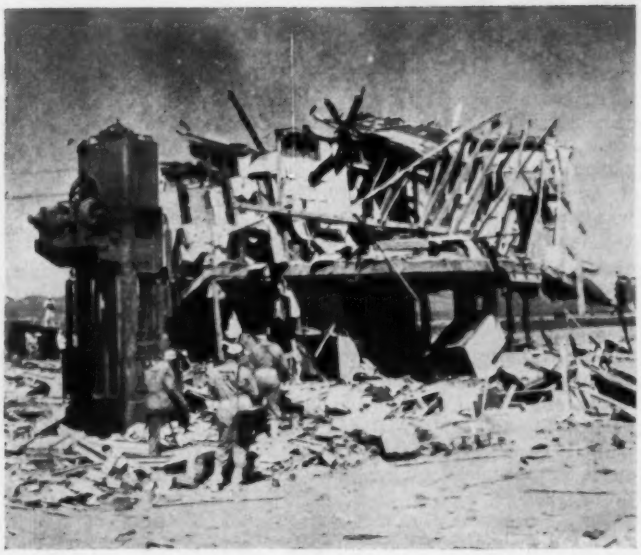
Here are the blast effects on the test machines:

- At 2750 ft from Ground Zero, machine tools were set up behind a concrete block wall, which was demolished by the blast. One of the test milling machines sheared off three anchor bolts, moved about 9 ft with the blast. There was no evidence of skid along the concrete foundation so it is assumed the blast picked up the milling machine and set it down 9 feet away.

Miller Irreparably Damaged

- Another test milling machine at 2750 feet was irreparably damaged, its main column broken off near the base, and the upper portion carried off by the blast. The main column casting (already 60% cracked prior to the blast) was pierced by a flying concrete block. The base oil reservoir, unprotected after the column broke off, showed no visible effects from thermal radiation, but the shade for the mill's lamp was scorched.
- Also at 2750 feet, one of the lathes showed only one possible effect of blast pressure: its 18-gage steel guard was lifted about 8 inches and





. . . and to a hydraulic press 4700 ft from the blast

Placed behind a two-story brick building, a hydraulic press wasn't damaged at all by the blast, although the brick building was demolished. Flying debris caused minor damage to controls and guards, but post-blast tests showed press's alignment wasn't affected

When Machine Tools Are A-Bombed?

driven toward the lathe, causing a shift plunger to pierce a 2-in. hole in the guard.

● Another test lathe at 2750 feet sheared eight anchor bolts, moved 9 feet with the blast, came to rest gently in the sand. Such basic parts as the bed, base, pedestals, tailstock and gear box appeared to be in good condition.

House Demolished, Press OK

Subjected to lesser blast, a large hydraulic press 4700 feet from Ground Zero, back of a two-story brick dwelling, showed no evidence of blast damage although the brick house was demolished. The press was somewhat shielded from the blast by the house and blast pressure wasn't enough to cause flying debris. Post-blast examination of the press showed the original horizontal and vertical positions to be unchanged, as were the relationship of the platen to the bolster, and the finish-machined surfaces of the ram and guides. There were no thermal effects even on oil-covered surfaces. In short, the machine was not affected by the blast except for minor damage to the control panel, pressure gage, and safety guard. Spare parts placed directly in back of the press were undisturbed.

6800 Ft: Little Damage

● A miller, pressure vessel and steam oven inside a test building 6800 feet from Ground Zero suffered no operational damage, although the building was demolished. The miller's vertical spindle arrangement was displaced 14°, the belt guard was blown up and back by the blast, a small brass hinge was broken, and a cast-aluminum belt guard was cracked slightly. The pressure vessel was undamaged. The steam oven moved slightly with the blast and turned over, but didn't fall or move far enough to hit other equipment. Its only damage: a slight dent in one corner. These pieces of equipment were damaged mostly by the weather when the building collapsed.

● Another milling machine, a modified one, and a shop-made pressure vessel and steam oven in another test building also 6800 feet from Ground Zero were damaged mainly by weather when the building collapsed. Only the miller was damaged, when the collapsing building broke the knee-elevating handwheel and moved the vertical spindle arrangement downward 38°.

Damage by debris was much more extensive:

● Machine accessories and spare parts placed behind or on the concrete wall at 2750 feet from Ground Zero were scattered as far as 100 feet. A 75-lb lathe chuck floated nearly 100 feet, landed gently on the sand. The milling machine here was severely damaged by flying building blocks and small parts. Flying debris sheared off the coolant return hose, knocked off the high-low speed plunger, severed a V belt, broke off the overarm stabilizer and spindle outboard bearing, and bent the table oiler plunger. A piece of building block pierced the knee gear box cover. Controls, etc, on the side of the mill away from the blast suffered little damage compared to the machine's near-side.

● The electrical control box on the other test miller was directly exposed to the blast and demolished by flying debris. A combination of debris and tumbling broke handwheels, gear guards, feed shaft and couplings, vari-speed drive, etc, to

NEWS REPORT

Atom bomb test (continued)

such an extent that the machine could not be reconstructed.

- One of the lathes at 2750 feet had three gears broken by debris, with some damage to a standpipe and tailstock assembly, but the machine's general level was unchanged.
- Another test lathe at 2750 feet was badly damaged by flying debris: (1) headstock gear broken at inspection ports but repairable, (2) apron shaft severely bent and mounting brackets broken off, (3) the leadscrew bent in two places, (4) spindle-clutch forward-reverse mechanism and rod broken loose from the apron and bed, (5) all drive belts broken, (6) belt guards twisted. But major components remained in position and machined surfaces showed no damage.

Most damage at 2750 feet seemed to be debris-incurred and repairable, and debris damage at the two stations farther out was minor.

Here are the conclusions drawn from the Operation Teapot test:

- Thermal radiation has no effect on metal parts. Enclosed and shielded electrical parts show no damage. Only exposed paper and cloth-like materials and dark-painted surfaces show thermal damage.
- Fragile appendages and mechanisms on the exteriors of machine tools suffered 80% of the total damage to the tools, but the damage is non-critical and easily repaired.
- Stockpiling of replacement parts and components is adequate protection against disaster. This means mobilization readiness can be accomplished without stockpiling entire machine tools.
- Designers and builders of machine tools might incorporate safeguards against nuclear effects when designing new machine tools.
- Machine tool builders should design around recessed and shielded appendages wherever possible.
- Machine tool builders should provide for stronger base mountings and methods of anchoring machines.
- Machine tools should be painted in lighter, more reflective colors, and telescoping or bellows arrangements should be provided for machined surfaces and critical areas.
- Plant architects should eliminate where possible massive overhead arrangements, and make use of readily shattering materials such as asbestos siding for walls and roof wherever feasible.
- Mobilization authorities should determine the kind and amount of replacement materials needed as protection against disaster, and institute such a program.

Now: a Man-Made Material Hard Enough To Scratch Diamonds

SCHENECTADY, N Y—Exploding the belief that "only diamond scratches diamond," 30-year-old Robert H Wentorf (shown above) has developed "Borazon," (cubic boron nitride), a material that scratches a diamond with ease (see photo inset) and stays hard at temperatures that literally burn-up a diamond. Dr Wentorf, a member of General Electric's Research Iaboratory staff, says borazon is "about the same hardness as a diamond—diamond scratches borazon just as borazon scratches diamond." Borazon, which is produced at a "superpressure" of 1-million psi, will not be available commercially for some time to come.

New 220,000-Sq-Ft Fafnir Plant

NEWINGTON, CONN—Now in full production stride is Fafnir Bearing Co's new 220,000-sq-ft plant here, where Fafnir has concentrated all machining and heat treating of rings for some 10,000 different types and sizes of ball bearings. The plant is constructed on a principle of concentration upon machining processes, rather than on a raw-stock-to-packaged-bearing operation such as that of Russia's Moscow automatic bearing line (AM—Jan 14 '57, p147). The plant is geared to the output of a wide variety of small runs. Features: completely open manufacturing floor, monorail bridge cranes, under-floor conveyors for chip removal, coolant filtration systems, belt conveyors, central washing station. If the concentration principle is successful, it will be expanded. Otherwise, the automation concept will be introduced at a later date.

IDEAL WORKING CONDITIONS AT FAFNIR result from the "open" plant principle, its 40-ft-candle illumination in production areas, interchangeable heating-cooling-ventilating system

Plastic Tooling Makes Some Inroads

CHICAGO—Plastic tooling is gaining wider acceptance in stamping plants, particularly those of the automotive industry, according to reports made at the Tooling Session of the Society for the Plastics Industry, held here at the Edgewater Beach Hotel February 5-7.

Ford Uses It

Ford Motor Co, for example, according to Donald Pickles, is using plastics to advantage in making tooling for prototype test cars because it can be made quickly and at a minimum cost. And Ford is beginning to increase use of reinforced plastics in making checking fixtures and gages, and for draw dies on such of its low-volume products as sports cars and special trucks. But, Mr Pickles said, "We have to creep before we can walk, so it is necessarily a slow process of developing new uses for plastic tools.'

To date, Ford has not considered using reinforced plastics for production drawing and forming dies because once tooled, press lines must operate without interruptions for die maintenance during cycled production schedules. But Ford's stamping plants are not shutting the door to developments in this field, because anything that might cut press tooling costs is highly desirable, particularly in these times of fast-rising tool costs—"where at one time we could change over to a new model for approximately $40 million, today these changeovers may cost as much as $100 million for one car line," Mr Pickles said.

Ford is using plastic-impregnated mahogany for original master models, Mr Pickles added, and duplicate models for die-sinking operations are made from reinforced plastics. Plastics are also in use at Ford for draw-die development on body panels and other parts that have difficult drawing characteristics. In such cases, before a metal die is made, one is constructed from reinforced plastic and its drawing characteristics studied.

Epoxy Resins Best?

Epoxy resins are the most desirable of available plastics for tooling, according to Ralph L Modano of Raytheon Mfg Co, who recommended that room-temperature cures be employed when making tools with epoxies—so that thermal expansion between the prototype and the plastic tool can be minimized. This is especially desirable, he said, where long tools or compound curves are involved.

The Advantages

These are the advantages of epoxy-glass fiber tooling, according to Mr Mondano:

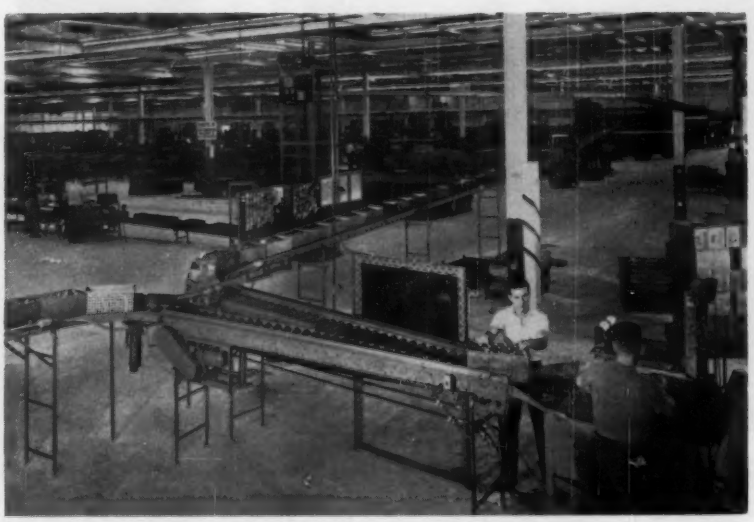
(1) Lightness, (2) moldability, (3) low cost, (4) speed of fabrication, (5) dimensional stability, (6) high impact resistance and absence of checking, (7) easy reworkability, (8) easy duplication, (9) its non-reliance upon skilled labor and short-supply die metals, and (10) ease of fabrication into thin sections.

Breaking the Thought Barrier

Let tool engineers, said Mr Modano, "Break down the barriers of conventional thinking, which oft-time limit the scope and progress of new ideas and techniques" when developing designs and applications for plastic tooling.

Machines 10,000 Bearing Types, Sizes

BELT CONVEYORS run alongside each of seven long batteries of automatic screw machines



FIRST MACHINING AREA at Fafnir's new plant has 180 automatic screw machines, from which bearing rings are automatically conveyed to this central washing station, thence to second machining, hardening furnaces, stock shelves

The Booming South: Coming Leader In Metalworking Productivity?

RICHMOND—The once-industrially-backward South can well top the nation in productivity in the next few years, according to James C Kelley, general manager of the American Machine Tool Distributors' Association, speaking at a regional meeting of southern tool distributors here.

Said Mr Kelley: "The 1000 or more new manufacturing plants that are now launching operations in the South each year are not handicapped —as are many older industries—by working with obsolete tools. . . . Given the flying start which new tooling and new plants make possible, the South's new industrial facilities are pointing and showing the way to almost unprecedented efficiency, economy and record rates of productivity."

Underlining the urgent need for widespread machine tool replacement throughout the U S, Mr Kelley said that "postwar studies show U S industrial productivity must be stepped up at least 1.5% each year to meet the requirements of our growing population. This means that machine tools must perform at rates at least 15% faster than they did 10 years ago."

The need for widespread replacement is even more evident on a quality basis, Mr Kelley said, "Today's precision requirements in metalworking are far more exacting than they were 10 or even five years ago," adding that product and component designs now specify many tolerances of ten-thousandths and even millionths of an inch—tolerances that older and fast-obsoleting machine tools cannot hope to meet.

Russian Electric Spark Grinder

Designed for processing of hard alloy parts, this electric spark grinding machine manufactured by the Kuibyshev carburetor plant in Leningrad is said to remove 3.5 ounces of metal a minute, achieving a quality of finish considerably higher than that of conventional models. One man can operate several machines

Cadillac Tank Plant Awarded Contract To Build M42-A's

CLEVELAND—Contracts to produce the M42-A track-laying vehicle-motorized gun carriage have been awarded here to the Cadillac Tank Plant. The contract is expected to carry Cadillac well into 1958.

M56 Output Scheduled

On the books, too, for the Cadillac plant is production of the M56, a lightweight, tank-like vehicle that has been successfully dropped by parachute. The M56 is the bright star on the horizon and contracts for its production are expected to be signed soon. Prototypes are currently being produced for future production at Cadillac, which is today employing about 1200 people, contrasted with its 8000 payroll during the first part of the Korean War.

Propose 10 Standard Pallet Sizes

CHICAGO—A cutback in the number of pallet sizes from the hundreds now in use in this country to just 10 standard sizes has been proposed by a committee of industrial and materials handling specialists in a tentative draft for "Proposed American Standard Pallet Sizes."

Co-sponsored by the Society of Industrial Packaging and Materials Handling Engineers and the American Society of Mechanical Engineers, the draft is the end-result of an extensive study into the use of pallets as related to transportation facilities, mechanical materials handling equipment, requirements of in-plant materials handling and other factors.

Means Better Use of Space

One of the study's principle objectives is greater utilization of trailer truck and rail area and cube. The 10 suggested pallet sizes are designed to make maximum use of shipping space and to simultaneously simplify materials handling in warehouses and plants.

Single copies of the tentative draft for proposed U S pallet sizes may be had from the Society of Industrial Packaging and Materials Handling Engineers, 111 West Jackson Blvd, Chicago, on a one-to-a-firm basis.

Raymond E Channock, controller of National Acme Co, has been elected vice president and treasurer

Morris L Hutchens, chief engineer of Kearney & Trecker Corp, has been elected vice president, engineering

Clifford H Hagberg has been named assistant sales manager of The Bullard Co. He was formerly district manager of the Chicago sales office

Names in the News . . .

Walter Holcroft, executive vice president of the Holcroft Co, Detroit, has been elected president of the Industrial Heating Equipment Association. **C Floyd Olmstead**, president of the Lee Wilson Engineering Co, Cleveland, has been named vice president.

W H Wendel, vice president and general manager of the Coated Abrasives Division of Carborundum Co, has been appointed group vice president in charge of the Stupakoff Div, Coated Abrasives Div, Curtis Machine Corp, and the Globar Div. **R A Barr**, sales manager of the Refractories Div, has been named general manager of the Stupakoff Div.

James R Keough has been elected vice president, manufacturing, at Fenwal Inc, Ashland, Mass. He was formerly manager of manufacturing.

W R Heckman, manager of industry sales for Clark Controller Co, Cleveland, has been promoted to assistant manager of operations; he will head the manufacturing section of the Operations Division. **J H Heuslein**, manager of production, has been appointed production planning manager.

R A Powley, assistant general manager of Ford Motor Co's Aircraft Engine Division, has been named general manager. **John A McCabe**, production manager, has been made general manufacturing manager. Mr Powley succeeds **John B Lawson**, appointed general manager of the company's Automatic Transmission Division.

Russell P Scholl, sales manager of Bryant Chucking Grinder Co's Gage & Spindle Division, has been promoted to manager of the Gage Section of the Division. **Hessler Gates, Jr**, chief gage engineer, has been named chief of engineering and production of the section.

Russell V Ringquist has been appointed sales manager of the Carbide Division of Besley-Welles Corp, South Beloit, Ill. He was formerly sales engineer for Firth Loach Metals.

William Hagel, vice president and executive assistant, United Engineering & Foundry Co, Pittsburgh, has been appointed vice president, operations.

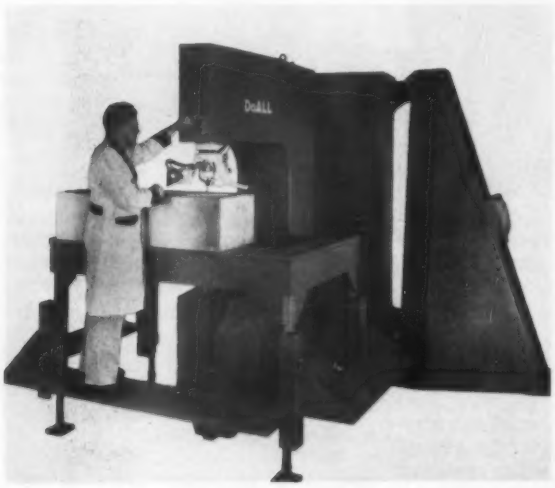
Charles Edison has been named board chairman of McGraw-Edison Co. **Max McGraw** will continue to serve as president, and **Alfred Bersted**, president of the Bersted Manufacturing Co division of McGraw-Edison, has been named executive vice president.

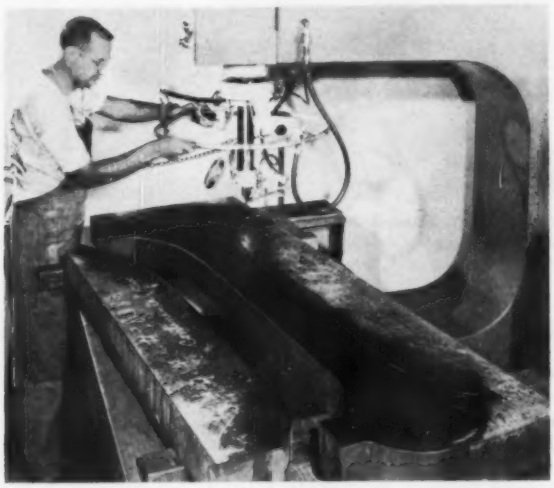
Duncan J Brown has been appointed supervisor of Brown & Sharpe milling machine sales. He has been serving as sales engineer on milling and grinding problems

J K Gerlach has been appointed sales manager of Cleveland Punch & Shear Works Co. He was formerly associated with Cyril Bath Co in a sales capacity

J F Forster, vice president and assistant general manager of Vickers Inc, has been appointed executive vice president of the company

New Shop Equipment





Thick Sections Are Sawed on DoAll Contour Cutter

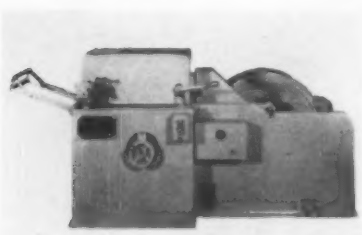
Based on the premise that when a workpiece is heavy, ungainly or unbalanced it is easier to move the tool than to move the work, the DoAll Model 5 Contour Machine has a work capacity of 70 sq ft and is capable of taking a straight cut 14½ ft long.

The machine achieves its great range and ease of handling by means of a hinged construction. The cutting and guiding mechanism is carried on by an aluminum yoke housing all elements for the cutting and power feed. Between the yoke and stationary member which is fastened to floor is an intermediate member. The three members are connected by hinges.

The yoke houses a complete 4-wheel variable speed bandsaw. Posts carrying the blade guides, together with power feed wheel, are connected to a countershaft through sprockets and chains. Any movement of top post is transmitted to bottom post and to feed wheel. Handwheel connected to top post permits operator to twist the saw blade 180° in either direction; turning of wheel also turns lower feed wheel at same time. The power feed wheel is driven by a torque motor and causes the entire yoke to move in direction that saw blade is pointed. Force of feed is controlled by rheostat, and wheel may be raised by means of an air cylinder.

Machine, designed for machining of large dies, reportedly cuts accurately, gives good surface finish, and removes stock without work hardening of cutting area. Generally, no clamping is required.

DoAll Co, 254 N Laurel Ave, Des Plaines, Ill



Brandes Adds Combination Coil-Cradle and Straightener to Line

A complete line of combination coil cradles and straightening machines are available which will handle stock weighing up to 15,000 lb. They are equipped with 6, 7 or 9 rolls, depending upon the model, and have a 4-to-1 speed reducer permitting a selection of feed speeds from 30 to 120 fpm.

Loop control system reduces to a few feet the distance between cradle and press without interfering with die handling and press service. Pinch and leveling rolls are over-sized and made of alloy steel.

Cradle is loaded by lowering coil with hoist or with coil storage cars or loading racks. For loading by the latter two methods, cradle is equipped with a positioning air cylinder.

Unit is designed to handle aluminum, brass and stainless steel coil, taking stock up to 36 in. OD, 14 in. wide and 0.093 in. thick.

Brandes Press Co, 6408 Euclid Ave, Cleveland 3, Ohio

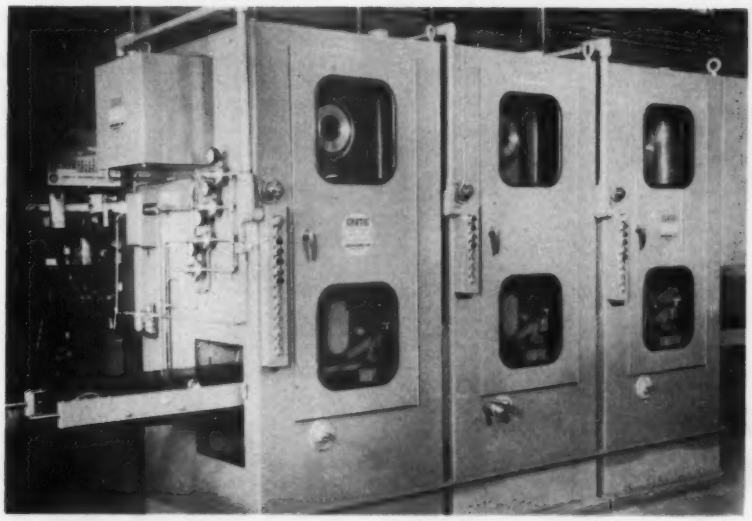
Thin Surface Coating Protects Aluminum Impact Extrusions

A thin surface cladding for aluminum impact extrusions has been developed by Alcoa to provide cathodic-corrosion protection, to facilitate finishing, or to make joining easier. Development reportedly will make feasible the use of aluminum impacts in such applications as water filters, electrical cases, steam traps, and process-industry operations where corrosive solutions or atmospheres are severe.

Technique employs company's Alcald process, in which a thin layer of aluminum alloy is bonded to sheet.

Aluminum Company of America, 1501 Alcoa Bldg, Pittsburgh 19, Penna

Materials and Parts . . .



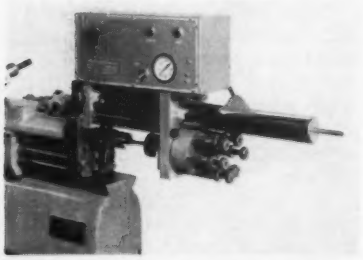
Three-Stage Grinding and Polishing Machine Composed of Standard Units

Curtis Straight - O - Matic, Model R600C-3, employs three abrasive belts over one conveyor belt and is equipped with wet grinding, oil mist applicator, automatic tracking and pneumatic tensioning of the 10-in. wide abrasive belts. This unit makes possible 3-grit polishing sequence, a 3-step stock removal for sizing, or combined polishing and grinding.

The neoprene rubber conveyor belt allows for relatively close tolerance work, and one user reports holding tolerance of ±.001 in. on small business machine parts. Fixtures for intricate parts can be easily attached to conveyor belt when necessary.

Standard models of the Straight-O-Matic line handle material up to 10 in. wide and 4 in. thick, and are available for surfacing one or both sides of coil or strip, with either wet or dry operation. Smaller parts can be ground, polished or deburred with either wet or dry operation on the conveyor-type machines.

Curtis Machine Div, Carborundum Co, Jamestown, N Y



Sandex Automatic Power Feed Fits Small Hand-Screw Turret Lathes

Model HR-1 turret-lathe converter is an automatic power feed that features a separate feed for each turret position with infinitely variable feed adjustments. Unit operates on 50 to 100-psi pressure and incorporates a hydraulic cylinder, giving it a very precise feed easily varied by turning a feed screw for each position. The turret is indexed automatically.

Packaged unit measures 16¾ x 10 x 3½ in., has a 4½-in. stroke, and is easily attached. It connects to the turret with a single removable pin, so that the machine is easily reconverted for hand use. A heavier unit with a longer stroke will soon be available for large turret lathes, company reports.

Sandex Automation, Inc, 678 Berriman St, Brooklyn 8, NY

...including

MACHINE TOOLS AND ATTACHMENTS

Duplicating Lathe 191
Automatic Microhoner 194
Rotary Milling Machine 200
Friction-Cut Bandsaw 204
Cutoff Saw 206

TOOLS AND ACCESSORIES

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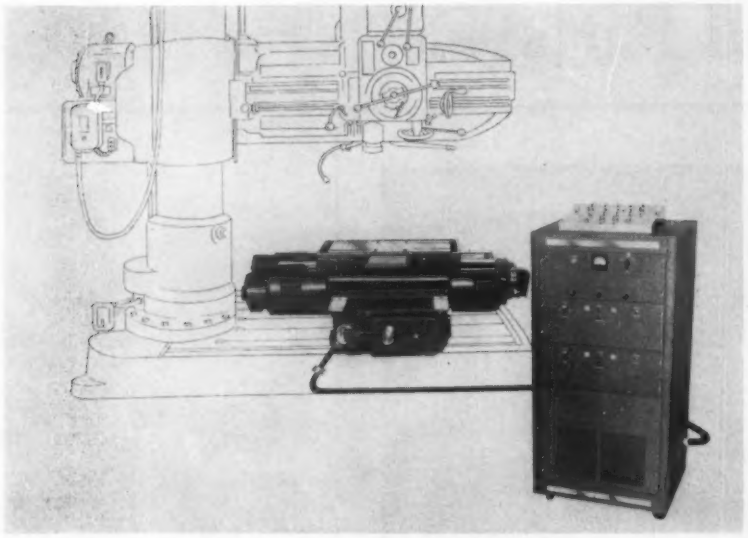
Temperature Controller 202
Leak Detector 219

PLANT SERVICE EQUIPMENT

Dust Collector 200
Fork-Lift Truck 210



Tape-Controlled Positioning Table Adapts to Most Machine Tools

The Allison positioning table, for use with existing machine tools having automatic spindles, was developed to fill need for a portable, precision machine of simple operation, requiring no special operator training. Operator merely places a blank on the machine and starts the sequence which automatically produces each part.

Table motion, which is controlled by magnetic tape, is along two perpendicular axes in a horizontal plane. Travel at 45° angles to these axes can be produced by electrically connecting the two axes during tape recording. Range of motion is 20 x 10 in., and maximum table thrust is 1000 lb. Over-all table dimensions are 50 x 35 x 15 in. A separate console, 22 x 19½ x 48 in. high, contains the tape which controls the table.

Because table motion and speed are continuously controlled, milling can be done in addition to stationary-part operations. To make matching right- and left-hand parts from a single recording, switches are provided to reverse all movements of either axis. Control switches are furnished to allow operator to stop the automatic sequence while a part is being made to inspect the cutter or settings. Another switch automatically restarts the tape immediately after rewinding for making a series of small parts strung out along the table top.

A 14-in.-dia reel, largest which the console can accommodate, holds enough recorded information to produce 40 min of table running time. Tool-operation time has no effect, because tape stops during these operations.

The system uses ½-in. magnetic tape on which 7 channels of information are recorded. Four of these produce table motion; one controls spindle movements of the machine to which table is attached; one stops the tape during machining; and one rewinds the tape when a part is finished. Although most recording is done by manual operation of the table, tapes can be prepared for milling circles, arcs, and a variety of odd shapes by using special recording equipment.

Control system is reportedly adaptable to nearly any machine tool. It has been successfully applied to an engine lathe.

Allison Equipment Co, 710 Wilshire Blvd, Santa Monica, Calif

Electronic Variable-Speed Drive Uses Low-Voltage Control

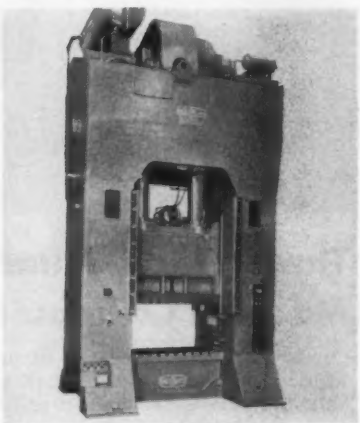
Consisting of an operator's control station, electronic control unit and a dc motor, Raytheon's electronic variable-speed drive is available in capacities from 30 to 150 hp. Electronic control features an ignitron-controlled three phase, full-wave rectifier system.

All components, with the exception of the dc motor, are static and have no inertial properties to slow down system response. Automatic compensation for line voltage fluctuations up to ± 10% is built into system.

Modular design permits use of many identical parts and assemblies in all sizes of the control. Up to 100 hp, the unit measures only 5 x 5 x 2½ ft.

A small low-power dc voltage is all that is necessary to control motor speed—this is available as function of the speed setting on operator's control station; or one or more external voltages may be used.

Raytheon Mfg Co, Commercial Equipment Div, 100 River St, Waltham 54, Mass



Cleveland Two-Point Press Has 500-Ton Capacity

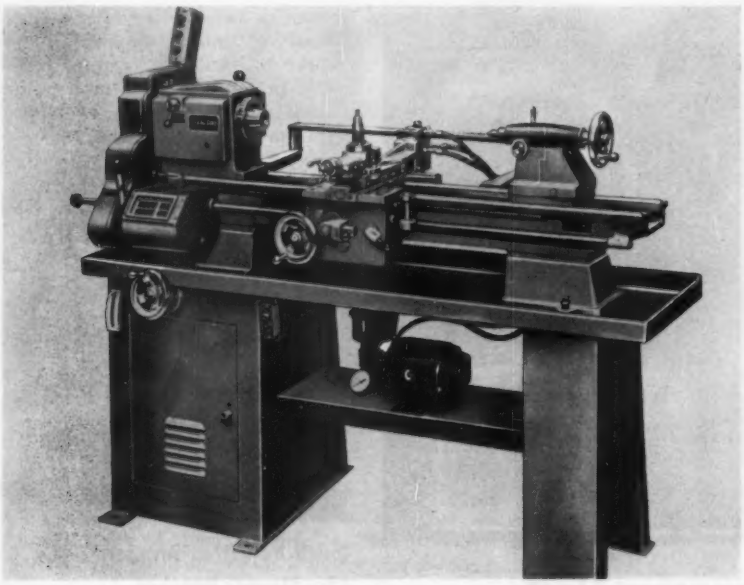
Model S2-500 two-point press, an addition to company's line, is equipped with Cleveland drum-type air friction clutch, with combination clutch and motor control. An automation control for auxiliary feeding devices, as well as additional 110 and 140-v receptacles, is provided on the double-geared unit.

Slide, which is counterbalanced by air, is arranged for power adjustment by a separate high-torque motor with a magnetic brake. Unit is also provided with safety blocks chained to disconnect plugs which, when pulled, break all the control circuits.

Die space is lighted from both sides by lights in both uprights, and the press is arranged with a recirculating oil system.

Other specifications: slide stroke, 12 in.; slide adjustment, 12 in.; shut height, 38 in.; bed and slide area, 36 x 60 in.; rpm, 30.

Cleveland Punch & Shear Works Co, Cleveland 14, Ohio



Clausing Hydraulic Tracer Lathe Provides Automatic Duplication

No. 6390 12-in. lathe is a heavy-duty duplicating lathe that provides automatic reproduction of such forms as multiple diameters, tapers, bevels, shoulders, radii, grooves, and chamfers. Power to feed firmly and hold cutting tool is furnished by hydraulic cylinder housed in a servo motor mounted on the lathe cross-slide. Motor, pump, reservoir, and pressure gage are an integral unit and are located on a shelf under the lathe chip pan. Templet-mounting bar is designed for templets made of ⅛- to ¼-in. flat stock.

Lathe bedways are flame hardened and precision ground. A variable-speed drive makes available any spindle speed from 43 to 222 rpm in back-gear drive and from 250 to 1300 rpm in open-belt drive without stopping lathe or shifting belts. Motor furnished is 1½ hp.

Lathe, which has a 59-in. bed, has 12¾-in. swing over bed, 12⅜-in. swing over saddle wings, and 7⅝-in. swing over cross slide. Distance between centers is 33½ in. Power longitudinal feeds range from 0.00065 to 0.0367 ipr of spindle. Cross-feed travel of 9⅛ in. is provided with feeds ranging from 0.00016 to 0.00917 ipr of spindle.

Tracer can handle work up to 2½-in. diameter differential, 18-in. length. Slide feed, in and out, is infinitely variable from 0 to 15 ipm. The tracer attachment can be purchased separately to fit any of company's 12-in. lathes. It does not restrict use of the lathe; only minutes are required to remove the tracer and replace the cross-feed screw.

Price of lathe with attachment is $2325 fob.

Atlas Press Co, Kalamazoo, Mich

Electronic Unit Tests Ignition Distributors on Assembly Line

The AIL Distributor Test Stand (shown above and on cover) was developed for the Ford Motor Co and is used for production-line testing of fully assembled distributors. It functionally checks each distributor and displays the performance characteristics on a 17-in. TV picture tube. The following characteristics are checked: dwell and dwell uniformity, advance angle-vs-speed, firing uniformity, and advance angle-vs-vacuum. Display size is 10 x 15 in. and over-all accuracy is within ±1% of full scale on either axis.

Dwell characteristics are shown by means of the distributor "make" and "break" pulses; advance angle-vs-speed is displayed by comparing timing of break pulses with reference pulses generated by a pulser wheel. Firing uniformity is also shown by this latter method. Vacuum advance is checked continuously by means of a vacuum-electrical transducer operating with a vacuum source included in test stand.

Power requirement is about 4 kva, 3 phase, 440 v, 60 cps. Unit is 40 in. wide, 50 in. deep and 7 ft high, with a working table level of 36 in. Total weight is about 2000 lb.

Airborne Instruments Laboratory, Inc, 160 Old Country Rd, Mineola, LI, NY

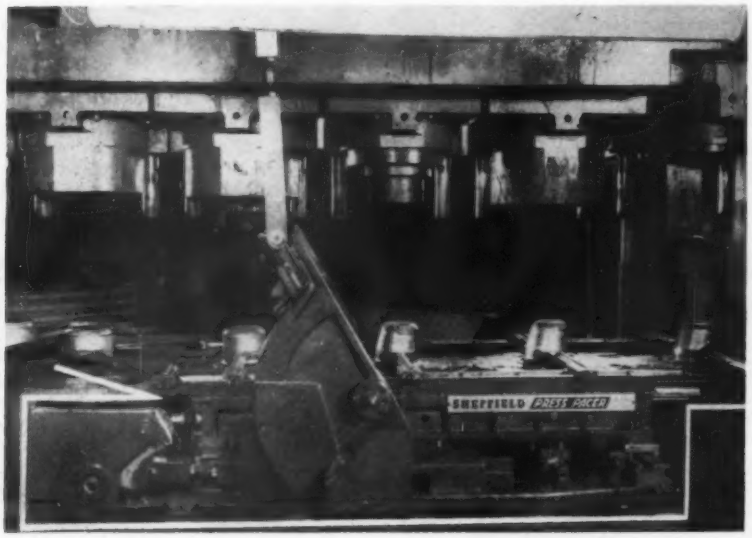
Submerged Arc Welding Unit Has Special Tractor Mounting

Automatic unit is designed for operations involving long seams, straight or curved as in shipbuilding, structural welding, or in welding of large tanks.

It will weld backward or forward, either when locked into position for a straight line seam, or when maneuvered by the operator on a curved or irregular seam. Adjustable nozzle permits operating either on a flat butt joint or on a fillet joint.

Two models are available, TSM-5D and TSM-5T; the latter incorporates remote control of welding voltage.

Hobart Brothers Co, Hobart Square, Troy, Ohio



Sheffield Portable Transfer Unit Automates Any Standard Press

Designed to convert any standard press into an automated press capable of handling a number of progressive operations and a broader range of sizes, the Press Pacer is a portable unit that bolts to the bed of press. It can transfer stampings from one die station to the next on each stroke of the ram, and can also be used to transfer parts between presses.

The unit is completely mechanical, is adjustable for different spacings between dies, for different ram strokes, and can be installed to run either front to back or left to right. Essentially the device consists of a pair of transfer rails—one on each side of the press — on which are mounted opposed pickup fingers that transfer parts to the next station on each upstroke of ram. Lever arm bolted to the ram provides transfer motion.

Standard model can be used on any press having a bed area approximately 42 x 72 in. and a 14-in. shut height. It has a stroke adjustment up to 12 in. and a transfer distance that is adjustable from 8 to 36 in. Pickup fingers are easily changed to handle different size parts.

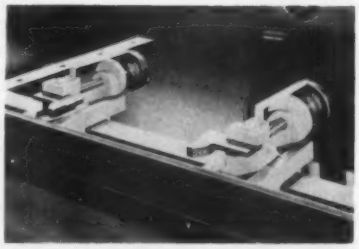
Sheffield Corp, Dayton 1, Ohio

Atomic Hydrogen Welder Repairs Dies, Molds, Machine Tools

General Electric has redesigned their atomic hydrogen welder. Standard equipment on the unit are an automatic hot start device that gives a current surge for positive starting, and power factor capacitors that help reduce line current requirements.

In the process, a jet of hydrogen, directed across the arc formed between a pair of tungsten electrodes, turns to atomic hydrogen and then recombines at a short distance from arc to form molecular hydrogen. This results in an intense heat concentration in a small area shielded by a hydrogen atmosphere. Gas flow is automatically controlled and ranges from 30 to 90 cfh during operation. Current range of unit is 7 to 100 amp.

Welding Dept, General Electric Co, Schenectady 5, NY

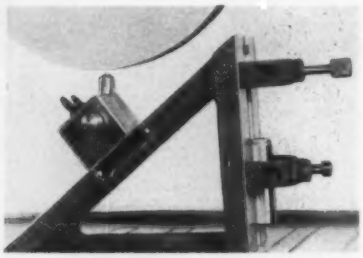


Press Brake Gage Reduces Setup Time

Use of Model 750 eliminates need for clamps and make-shift setups. Two or a series of gages are fastened to a ¾ x 2-in. bar in rear of press brake. Each independent unit has its own micrometer reading and a locknut to lock reading after setting.

Scale mounted on side has a pointer to facilitate reading the 0 to 3½-in. range. Gages may be set in any desired position by sliding them on the bar to the required location, and locking with two thumb screws.

Addresso Manufacturing Co, 9105 W King St, Franklin Park, Ill



Quick-Adjusting Dresser Also Mounts Punches

Inclined-plane dresser for surface-grinder wheels allows adjusting diamond to wheel height without fussing with fine wheelhead feed. Unit will dress sides and face of wheel while mounted on either a magnetic or non-magnetic table.

Holder attachment on vertical leg will grip small tools and punches so several can be ground to same height.

Dover Machine Sales Co, 140 Dover St, Boston

Electro-Hydraulic Servos Control Linear and Rotary Motion Machines

Two building block units, a transistorized servo amplifier and an electro-hydraulic servo valve make possible the application of hydraulic power to many functions previously limited to electric drives.

The amplifier (XRJ301A) receives signal inputs from any standard 60-cycle ac source and is designed for parallel summation, ratio comparison or series summation of input signals. It supplies driving power for the 3-way servo valve (XVJ300A) which, in turn, controls flow of oil to hydraulic linear or rotary motion drives. Valve is available in ratings up to 10 gpm and 3000 psi.

System can be used to control hydraulic presses, reciprocating drives, screw feeds and spindle drives. Control combinations possible include stroke control feedback, pressure flow feedback, feedback of load position, velocity or force.

Machine Controls Div, Minneapolis-Honeywell Regulator Co, Fourth Ave S, Minneapolis, Minn

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FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 MACHINE TOOLS — *South Bend Lathe Works, South Bend 22, Ind.* 80-page catalog 5700 illustrates, describes, gives specifications and prices for engine, toolroom, and turret lathes; vertical spindle milling machines; bench shapers, drill-presses; and pedestal tool grinders. Attachments, tools, chucks, accessories listed.

2 DIE-CASTING MACHINES—*Cleveland Automatic Machine Co, Cincinnati 12, Ohio.* 8-page bulletin gives data on models with 50, 200, 400, and 600-ton locking pressure. Units are universal high-pressure, hydraulic, hot or cold chamber.

3 TAPE-CONTROL SYSTEM—*Electronic Control Systems, Inc, 2136 Westwood Blvd, Los Angeles 25, Calif.* 12-page booklet describes Digimatic system for numerical control of machine tools by magnetic tape. Cost-reducing features listed, elements illustrated.

4 SHEET-METAL MACHINERY—*Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* 20-page illustrated booklet 202 gives data on power-operated units for light sheet-metal work. Covers shears, press brakes, combination machines, notching and punching units. 32-page booklet 201 catalogs line of manually operated machines and tools including folders and brakes, beaders, slip-roll forming units, foot shears.

5 TURRET PUNCH PRESSES—*Wiedemann Machine Co, 4872 Wissahickon Ave, Philadelphia 29, Penna.* 4-page illustrated bulletin 201 describes line for use in short-run piercing. Data and specifications on units from hand-operated R-2 to 150-ton capacity R-15. Information included on three basic types of work locating gages for precise location of material without layout.

6 MULTIPLE ROTARY SLITTING LINES—*Yoder Co, 5500 Walworth Ave, Cleveland 2, Ohio.* 76-page illustrated handbook contains information on design, selection and operation, including time studies and analysis of operating cycles. Gives specifications and capacity tables on slitters, uncoilers, recoilers, coil cars, and scrap choppers.

7 PRESSROOM EQUIPMENT—*Special Engineering Service, Inc, 8161 Livernois, Detroit 4, Mich.* 12-page catalog describes features, gives specifications of hydraulic punch press feeds, combination cradle and straighteners, loading ramps, power-driven and plain stock straighteners, air feeds.

8 STRAIGHT LINE TRANSFER MACHINES—*Ferguson Machine Corp, PO Box 5841, St Louis 21, Mo.* Illustrated bulletin covers revised and expanded line of standard Trans-O-Mator units for automatic assembly. Typical applications and design features described; dimensions of bases with 6, 8, 12, 16, and 24-in. strokes given.

TOOLS AND ACCESSORIES

9 GAGES—*Cadillac Gage Co, PO Box 3806, Detroit 5, Mich.* 40-page illustrated catalog describes, gives specifications, prices, and sizes of line of thread plug, thread ring, and special gages of all types. Section covers Pla-Chek gages in range of sizes for fast surface plate inspections.

10 AIR TOOLS—*Thor Power Tool Co, Aurora, Ill.* 84-page second edition of catalog 53 contains illustrated descriptions and specifications of 40 basic tools with model variations, accessories, and adaptors.

11 GEAR SHAVING CUTTERS—*National Broach & Machine Co, 5800 St Jean, Detroit 13, Mich.* 12-page bulletin CR 56-10 provides information on characteristics, mounting data, speeds and feeds, coolants, cutter life, repair and reconstruction, storage, and a checklist for problems and maintenance.

12 BRINELL HARDNESS TESTER—*Tinius Olsen Testing Machine Co, 5806 Easton Rd, Willow Grove, Penna.* 4-page illustrated bulletin 52 describes air-operated Air-O-Brinell; covers function and operating principles, provides specifications for two available models.

13 PORTABLE TOOLS—*Skil Corp, 5033 Elston Ave, Chicago 30, Ill.* 50-page catalog pictures and describes variety of tools including grinders, wheels,

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saws and saw blades, sanders, brushes, and accessories.

14 SOLID CARBIDE END MILLS—*M A Ford Mfg Co, 732 W River St, Davenport, Iowa.* 12-page catalog 601 contains data on diameter, flute radius, shank diameter, over-all length of 11 different types of mills. Includes information on HSS and carbide rotary cutters, countersinks, and special tools.

15 PROFILE RECORDER—*Micrometrical Manufacturing Co, 345 S Main St, Ann Arbor, Mich.* 4-page illustrated bulletin discusses features and elements of the Proficorder, an instrument for measuring and recording the profile of practically any machined or finished surface.

16 DEEP HOLE DRILLS—*High Standard Manufacturing Corp, 1817 Dixwell Ave, Hamden 14, Conn.* Brochure contains data sheets on Hi-Standard units. These present general information, illustrate typical installations; diagrams and specifications cover inserted carbide, solid carbide and HSS drills. Details on drill tips and shank construction, sharpening instructions, machine setups.

HEAT TREATING AND WELDING

17 ARC CUTTING—*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 24-page catalog 3170 (Form ADE 880) gives details on Aircomatic cutting, a method for straight line and shape cutting of non-ferrous metals. Process, employing standard Aircomatic welding equipment for manual and machine cutting, is particularly applicable for high-speed cutting and shaping of plates and parts to be joined by gas-shielded arc welding.

18 MAGNETIC FORCE WELDER—*Precision Welder & Flexopress Corp, 3520 Ibsen Ave, Cincinnati 9, Ohio.* 6-page bulletin MF-100 describes principle, lists variety of materials that can be joined; provides information on machine controls and adjustments; design and construction features, specifications included.

PLANT SERVICE EQUIPMENT

19 AIR-POWERED RECIPROCATING PUMPS—*Gray Co, 1045 Sibley St, NE, Minneapolis 13, Minn.* 44-page catalog 453 illustrates and describes Powerflo line of pumps and equipment for paint circulating systems, viscous material transfer, extrusion applications, and spraying. Four series available in varying power ratios.

20 HEAVY-DUTY FORK TRUCKS—*Mercury Manufacturing Co, 4044 S Halsted St, Chicago 9, Ill.* Three two-page bulletins, 530, 730, and 830 give details and specifications of the Yak and Yank battery units, with 5000, 7000, and 8000-lb load capacities. Performance, dimensions, weight, electrical and mechanical features covered.

21 DUST CONTROL—*Pangborn Corp, Hagerstown, Md.* 16-page illustrated bulletin 922 covers range of equipment and accessories, lists primary component parts of an engineered system.

22 DOCK RAMPS—*Globe Hoist Co, E Mermaid Lane at Queen St, Philadelphia 18, Penna.* 6-page bulletin contains illustrated description of Trans-O-Matic line of power-operated, automatic-leveling ramps with capacity rating of 20,000 lb.

23 RATCHET HOIST—*Yale & Towne Manufacturing Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna.* 8-page catalog 5092 covers lines of roller chain and link chain Pul-Lifts available in capacities of from ¾ to 15 tons.

PARTS AND MATERIALS

24 HEAVY-DUTY LIMIT SWITCHES—*R B Denison Mfg Co, 102 St Clair Ave, NW, Cleveland 13, Ohio.* 8-page bulletin 956 describes 21 contact arrangements. Gives details on housing, ampere ratings, wiring diagrams, operating data, and electrical characteristics of each of the nine standard models of Loxswitch line.

25 MOTOR SELECTION MANUAL—*Century Electric Co, 1806 Pine St, St Louis 3, Mo.* 12-page Application Guide No. 102 contains illustrated data on electric motors. All factors to be considered in selection of proper motor for specific application arranged in tabular form.

26 COLD ROLLED CARBON SPRING STEEL—*American Iron & Steel Institute, 150 E 42nd St, New York 17, NY.* 36-page Steel Products Manual discusses metallurgical aspects, manufacturing practices, quality descriptions, chemical composition.

27 INDEXING TURNTABLES—*Eisler Engineering Co, 750 S 13 St, Newark 3, NJ.* 32-page illustrated catalog gives data on complete line of turntables and variable speed controls.

28 STEEL CASTINGS—*Dodge Steel Co, 6501 Tacony St, Philadelphia 35, Penna.* 20-page specifications folder includes complete description of 12 Dodge metals for casting. Chemical, physical, and general properties given for each, as well as special heat treatment data.

29 TUBE FITTINGS—*Parker Appliance Co, Tube & Hose Fittings Div, 17325 Euclid Ave, Cleveland 12, Ohio.* 52-page illustrated catalog 4310 covers Triple-lok line made in brass, steel, stainless, and aluminum; all shapes including new swivel nut type and straight threaded fittings with O-rings for new SAE straight thread boss.

30 TABLETOP CONVEYOR CHAINS—*Chain Belt Co, Dept PR, Milwaukee 1, Wis.* 26-page bulletin 56-60 pictures and describes Rex line available in steel or nylon. Applications illustrated; sprocket information; lubrication and conveyor design discussed.

MISCELLANEOUS

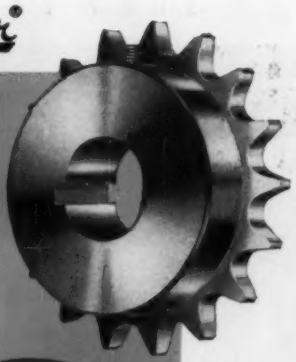
31 LATHE RECONDITIONING—*De Silvey Corp, 200 Pennsylvania Ave, East Aurora, NY.* 8-page brochure illustrates and describes precision rebuilding and reconditioning operations performed on Warner & Swasey turret lathes.

32 EXTRUSION PROCESS—*Claude C Slate Co, 1733 Flower St, Glendale 1, Calif.* Brochure describes typical parts that can be produced by Flotrusion process for cold flowing various metals into tubular forms of all sizes and shapes. Advantages, applications discussed.

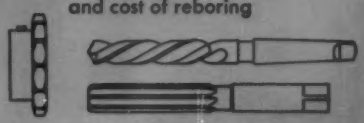
Here's how YOU SAVE with BOSTON Gear

BORED-TO-SIZE SPROCKETS

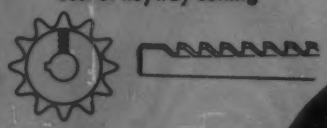
complete with keyway and set screw... ready to install



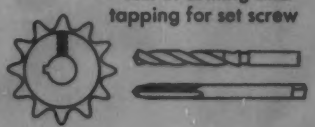
YOU SAVE time and cost of reboring



YOU SAVE time and cost of keyway cutting



YOU SAVE time and cost of drilling and tapping for set screw



YOU SAVE delay and cost of downtime in emergencies

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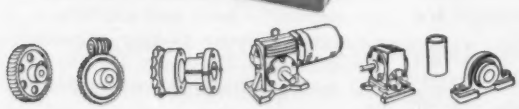
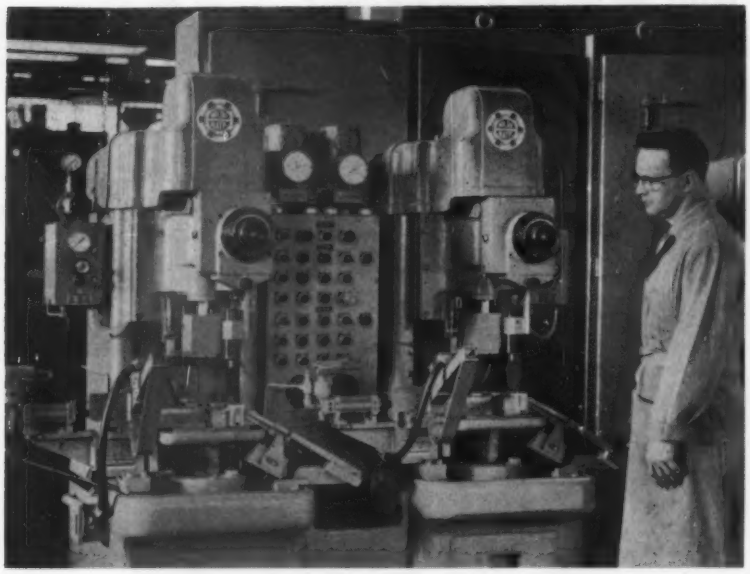


For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book.



Automatic Microhoner Generates Bore Square With Flat End Faces

Model 738 Microhoner is a completely automatic machine which generates a bore that is square with "paral-flat" end faces on a part, to provide accurate locating surfaces for subsequent operations. Illustration shows two machines mounted for high-volume production.

Automatic loading of parts is accomplished by a large-capacity loader and a gravity chute which carries parts to pre-feed position. A plunger moves part onto the fixture table. Automatic feeding and aligning of parts is provided: As table rises, part slips over tool, which expands to align part with spindle; part is then clamped on its end faces in the fixture, square with the spindle.

Automatic sizing (through company's Microsize control) ends cycle when bore is to required diameter. Table automatically lowers, part is moved out of honing position, and automatic after-gaging by an air gage occurs while next part is being honed. Automatic segregation of parts is controlled by the air gage; as parts leave machine, they are segregated according to the bore diameters. Automatic stone-wear indicator visually indicates amount of usable abrasive in the tool. When abrasive is completely worn down, or if a pre-determined number of parts is not within tolerances, machine shuts down automatically.

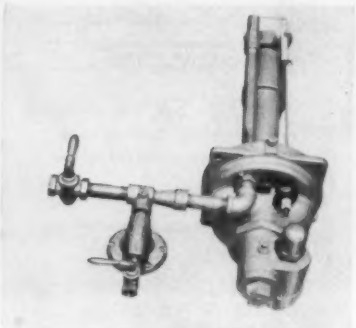
Micromatic Hone Corp, 8100 Schoolcraft, Detroit 38, Mich

Special Clearing Press Features Many Built-In Accessories

650-ton double-action enclosed press, built for the automotive industry, is floor mounted and requires no pit or foundation for installation. It can be moved from one place to another within the plant and be readied for work almost instantly. All electrical controls and accessory equipment are built into the frame.

Master control panel, press air manifold, limit switch, air manifold, and terminal block cabinets are all built into press uprights and confined in dust-tight enclosures. Slide counterbalance cylinders are also built in and are self-contained, eliminating the need for external surge tanks. Built-in die lights are provided for the die area. Lubrication of all moving parts is automatically taken care of by a central oil-lubricating system.

Clearing Machine Corp, Div of U S Industries, Inc, 6500 W 65th St, Chicago 38, Ill



Eclipse Gas-Burner Assemblies Fit Radiant-Tube Heaters

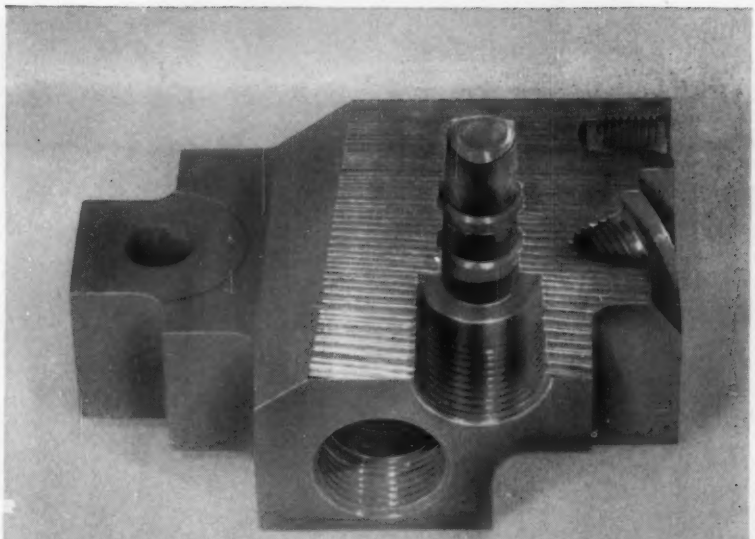
Radiant-tube burners in RT Series are packaged units that can be installed directly on metal or ceramic radiant tubes. They are sealed, nozzle-mixing units that keep air and gas separate up to the point of discharge, minimizing danger of flashback or backfire.

Five series, ranging in capacity from 250,000 to 625,000 Btu, are offered. Tube sizes vary from 4½ to 8⅝ in. OD. Mounting can be slip-fit or flange type. Regulation of air and gas can be fixed or adjustable. Three types of ignition are available: gas pilot, spark, or pilot-spark combination. Another optional feature is automatic control.

Eclipse Fuel Engineering Co, Rockford, Ill

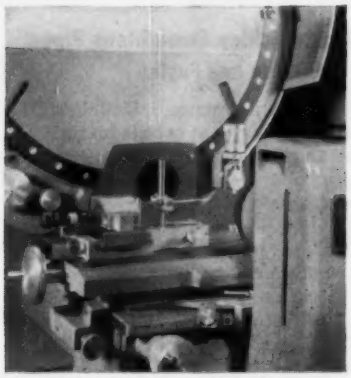
Plastic balls, called Go-Mist balls, are molded from Bakelite polyethylene and noxious fumes rising from plating tanks. An effective blanket of these balls, about 55 per sq ft, will prevent gas bubbles from rising to the surface where they normally burst, producing corrosive mist. Balls are chemically inert, and also help to maintain uniform plating solution temperatures. They are 1½ in. in dia, and reportedly have indefinite life.

Cosom Industries, Inc, 6012 Wayzata Blvd, Minneapolis 16, Minn

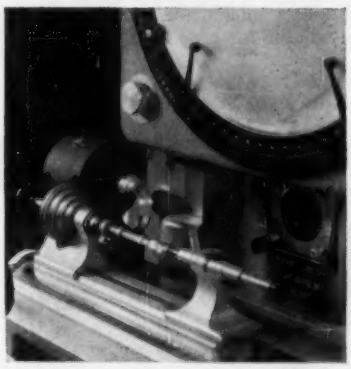


1. Cross section through pressure control valve body shows tricky inspection problem. There are 12 linear and 8 angular dimensions to be measured within the hole shown in cutaway.

2. Part of the receiving inspection department of the aircraft components plant. Model 30 Contour Projector is at the left. Operators work comfortably in normal lighting.



3. Close-up of Model 30 shows tracer fixture and pantagraph. The tracer fixture follows the contours of the hole and translates them into an image on the screen for accurate gaging.



4. In another application, a Kodak Contour Projector, Model 4, is used with a jeweler's lathe, which enables the operator to grind the radii on a servo mechanism piston to a tolerance of .0005" by watching the magnified image during grinding.

2/3 cut in gaging time

helped prove how 23 more Kodak Contour Projectors would return their cost inside 12 months

A leading manufacturer of aircraft components recently purchased 23 Kodak Contour Projectors when cost studies showed the machines *would pay for themselves in 12 months.*

The studies were based on the time and labor saved by Kodak Contour Projectors in inspection of parts like the pressure control valve body pictured above.

This component has 12 linear and 8 angular dimensions to be checked—*all inside a blind hole.* With a Kodak Contour Projector, Model 30, inspection of 25 pieces takes just 3½ hours. Formerly, the same job took 10 hours and was less accurate. Hundreds of manufacturers across the country have had similar experiences with all sorts of complex parts, large and small.

Whether your problem involves receiving, production, or final inspection, there's a Kodak Contour Projector to do the job quickly, accurately, and at low cost. To learn more about how optical gaging can work for you, send for your copy of the free booklet "Projection Gaging with Kodak Contour Projectors," or write for the name of the representative in your area. No obligation, of course.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.
Apparatus and Optical Division

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

Sutton Machine Straightens Pipe At 1000 fpm and Faster

Sutton Straightener, Model 2JM Special, operates at speeds up to 1000 fpm and faster, depending upon the application. Designed to handle continuous-weld pipe of ⅛ to 2-in. diameter, this model is powered by 230-v dc adjustable-speed motors rated 75 to 100 hp, in a range of 400 to 1600 rpm.

Unit incorporates Sutton 5-roll principle; rolls are positioned for a horizontal pass line. A pressure roll is located between two sets of opposed rolls with each set having one opposed driven roll and one idler roll.

Another model, the 2JM Modified, is available for pipe from ½ to 4 in. in diameter.

Sutton Engineering Co, First National Bank Bldg, Pittsburgh 22, Penna

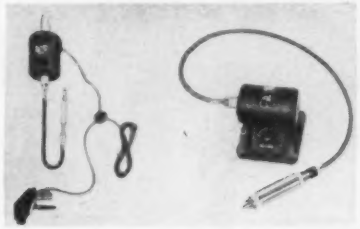
Portable Power Screwdriver Has Automatic Self-Feeder

Semspak (R) is a portable, self-feeding completely automatic power screwdriver designed for mass assembly operations. Screws are held in an automatically loaded cartridge and are automatically fed into driving jaws.

Operator has full view of work, screw and driving jaws. Cartridge holds 60 #8 screws, slightly less with #10's. Unit will accommodate screws with 7/16-in. minimum length and a 1½-in. maximum length and either round, pan, oval, flat, fillister, hex, slotted or Phillips head.

Device is 18 in. long, weighs 6½ lb, and is powered by a lightweight air hose. Torque is easily adjusted.

Shakeproof Div, Illinois Tool Works, St Charles Rd, Elgin, Ill



Overhead and Bench-Type Flexible Shaft Machines Available

L & R overhead unit and bench-type unit are designed for filing, burring, drilling, grinding, polishing, riveting and piercing. The overhead style has 1/12-hp, 115-v ac-dc, ball-bearing motor, No. O Jacobs-style chuck, speeds to 10,000 rpm, and dynamically balanced armature.

Bench-type unit uses a 5-speed, 1/10-hp, 115-v ac motor, Jacobs-style chuck, and has adjustable speeds ranging from 1500 to 10,000 rpm.

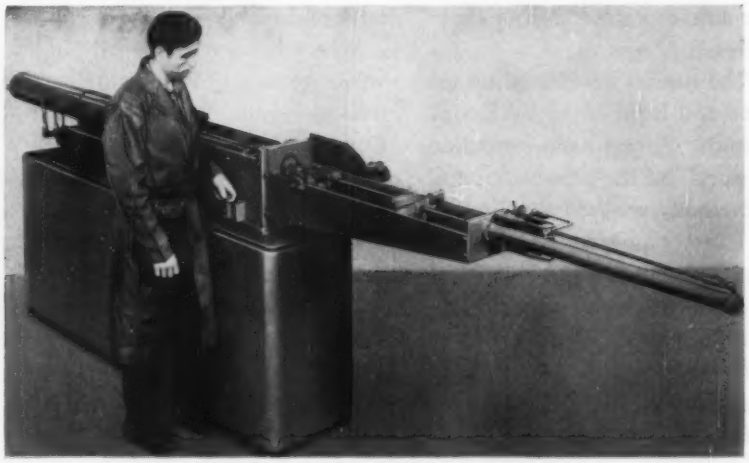
L & R Mfg Co, 577 Elm St, Arlington, NJ

Wallace Bandsaw Cuts Wood or Metal, Has Adjustable Table

Combination wood and metalworking bandsaw, Model No. 56, has a maximum capacity of 12 in. under the guide and 17¾ in. between saw blade and frame.

Unit is available in a straight belted drive suitable for use on wood and non-ferrous metals, and also in a gear reduction model permitting full range of cutting speeds from 50 to 3800 fpm. Universal motor mount allows use of any motor from ½ to 2 hp

J D Wallace & Co, 800 N Detroit St, Warsaw, Ind



AUTOMOTIVE WINDSHIELD-WIPER BRACKETS are machined on automatic broaching fixture, which broaches a round hole in each of two ⅜-in. dia, 1-in.-long bushings that are pressed into the brackets. Air-hydraulic cylinder pulls broach through part; two other air cylinders operate broach-retriever mechanism and part-ejection device. Unit has 25-in. stroke, max pull force of 1450 lb, and broach speed of 70 fpm—*National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich*

JUST PUBLISHED!

New 24-page brochure gives complete engineering data

Here's the story of fatigue-proof steel bars

MADE BY THE e.t.d. PROCESS

Elevated Temperature Drawing

*a **new** material—made by*

*a **new** process—with*

*a **new** combination of properties*

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Uniformity
Fatigue Resistance
Wear Resistance
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Plus Accuracy, Smooth Finish, and Straightness

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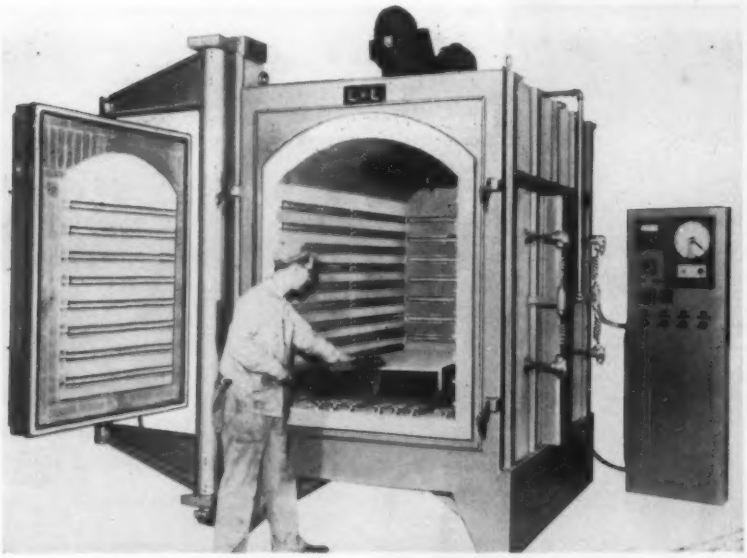


L & L Forced-Convection Furnaces Come in Fifteen Standard Sizes

Engineered for such industrial operations as aluminum brazing, tempering, drawing, normalizing, hardening, and other operations with and without protective and special atmospheres, Series HFC forced-convection furnaces are available in 15 standard models. Sizes (inside dimensions) vary from 13 in. high x 13 in. wide x 25 in. deep to 36 in. high x 40 in. wide x 72 in. deep. Special sizes can also be quoted.

Very close gradients are automatically maintained by powerful fans that circulate the atmosphere in the firing chamber. Control is said to be closely kept over the entire heat range from 250 to 1875 F. Heating elements are heavy-gage Nichrome of low-gradient type, and are supported in company's Dyna-Glow element holders.

Furnace shown in illustration is equipped with a Leeds & Northrup recorder controller with special instruments for regulating input with input controllers, 4 thermocouples, and special timer. Unit can heat 2000 lb of steel to 1875 F in 3½ hr from 70 F. Largest furnace is shown here.

L & L Mfg Co, Upland, Delaware County, Penna

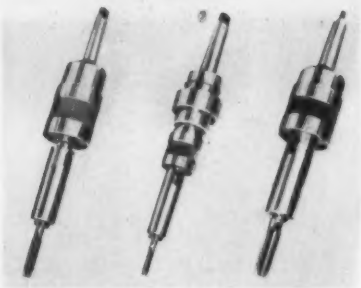
PORTABLE TOGGLE MECHANISM, designed for small high-speed DSMT die-casting machines, is interchangeable with all existing models. New features include: more massive air cylinder, stronger and larger ejector box, heavier duty toggle links, and die block bushing supports. Unit is cored out to make it portable and capable of high speed operation. Operating valve has speed control, and tie bars are adjustable—*Imported by British Industries Corp, Dept PR-13, DCMT Div, Port Washington, NY*

Aluminum Etchant Cleans and Brightens Aluminum Surfaces

Hanson-Van Winkle-Munning's new 85S aluminum cleaner was developed for use as a caustic etchant bath. Material contains an inhibitor which reportedly prevents formation of scale on coils and tank walls. Formation of sodium aluminate—an etching inhibitor at high concentrations—is minimized, thus allowing the bath to be used for long periods without dumping.

Recommended cleaning cycle consists of precleaning in company's Matawan Cleaner 52, rinse, etching in Aluminum 85S etchant, rinse, desmut in Matawan A-200, rinse, hot water rinse, and dry.

Hanson-Van Winkle-Munning Co, Matawan, NJ



Three Safe-Torque Tap Drivers Expand Scully-Jones Line

Safe-Torque tap drivers feature an over-running roller drive design that releases completely when preset torque is reached. Torque is transmitted when rollers are wedged between drive shell and raised cams on the drive collet. When preset torque is reached, rollers roll past high points on cam and are locked in free position.

Tension and compression type (left) allows tap to jump away from last thread when being withdrawn. Sizes range from No. 10 to ⅝ in.; torque from 50 to 700 in.-lb. Quick change type (center) allows quick tool change without stopping machine. Sizes range from No. 10 to 1 in.; torque from 40 to 1900 in.-lb. Heavy-duty type comes in sizes from ½ to 1½ in.; torque from 500 to 2400 in.-lb.

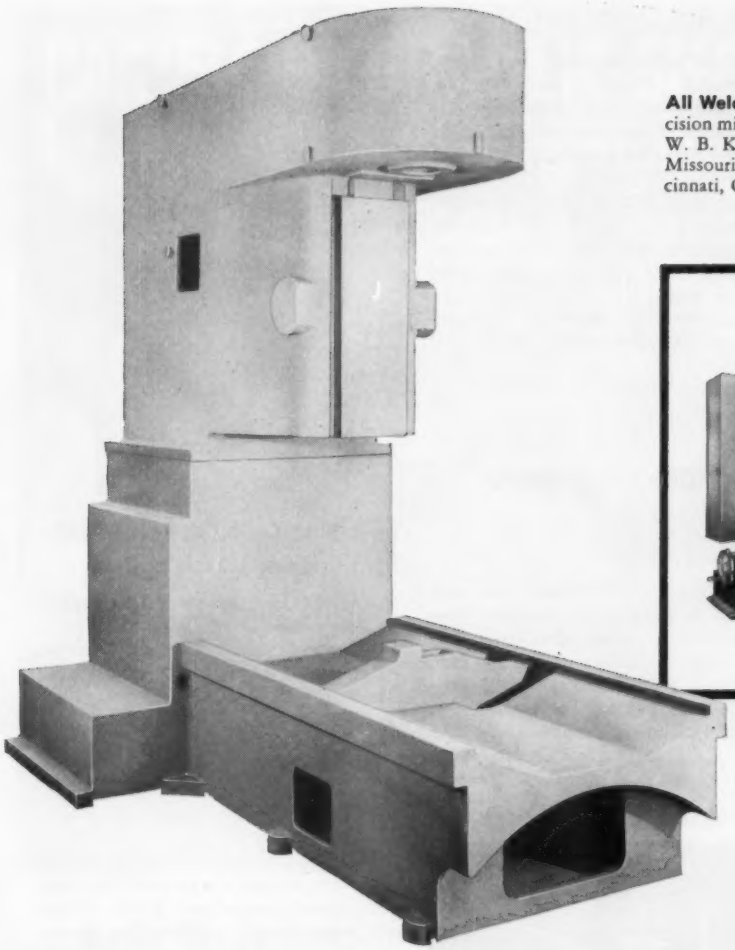
Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill

GE Xeroradiography Extends Use Of Industrial X-Ray Inspection

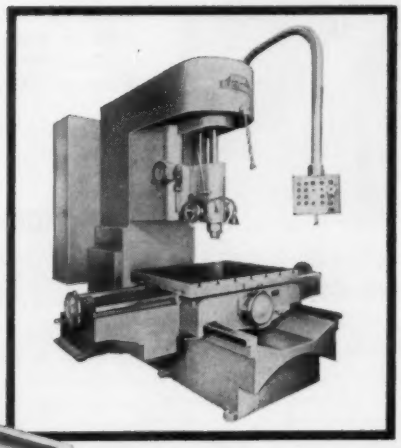
New process will reportedly extend use of X-ray inspection. X-ray images reportedly are produced faster and at less cost by a new, entirely dry process. Xeroradiography uses plates that can be erased and used over again, and produces, in 20 to 45 sec after exposure, a finely detailed image. Process is expected to find application in field of light alloys and where short-exposure, high-voltage X-rays were formerly required.

A selenium-coated metal plate is electrostatically charged before exposure. X-rays passing through casting partially discharge plate, in inverse proportion to density of object. Result is latent electrostatic image. A powder is sprayed on the plate; image is formed as particles gather in higher-charged areas.

General Electric Co, X-Ray Dept, Milwaukee 1, Wis



All Welded Steel Base and Column for precision milling and boring machine. Designed by W. B. Knight Machinery Company, St. Louis, Missouri. Fabricated by Littleford Brothers, Cincinnati, Ohio.



MORE RIGID TO HOLD CLOSER ALIGNMENT

... Welded steel design makes it possible at lower cost

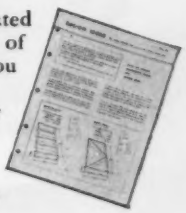
BY proper use of welded steel construction, many types of machines can be built to hold closer alignment and maintain higher tolerances. This is possible because steel is 2½ times as rigid as iron.

Because steel designs use less material, and because steel costs only a third as much per pound as iron, costs can be lowered substantially.

On these precision machines, rigidity for close alignment is combined with modern appearance. Additional savings in cost are possible since patterns and castings are eliminated.

Benefits like these could be duplicated in your designs. Lincoln's 45 years of cost-cutting experience can show you how.

Designers and engineers write for bulletins on designing for steel.



THE LINCOLN ELECTRIC COMPANY

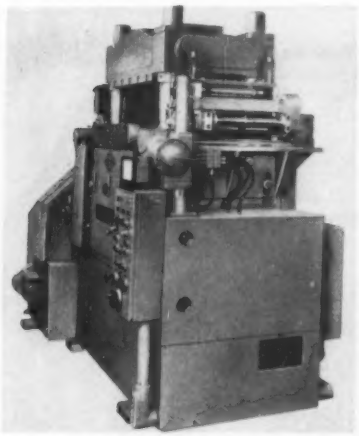
Dept. 2013, Cleveland 17, Ohio

When steel is three times stronger than iron

Has 2½ times the rigidity

Yet costs ⅓ as much

WHY aren't all your products designed for welded steel



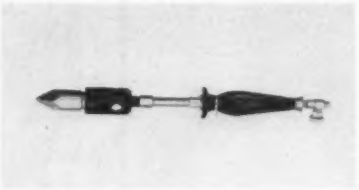
Alpha High-Speed Automatic Stamping Press Requires No Pit

Alpha 75-ton, double-crank direct drive press handles long, unbalanced, progressive dies, and is operated at shoulder level. Under-drive mechanism pulls head down, eliminating overhead thrust on head. Four-post construction assures alignment of punch and die.

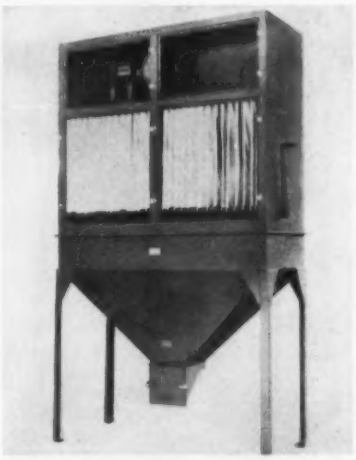
Other features include complete clearance between head rod posts, pneumatic clutch and brake, air counter-balances, positive shut height lock to prevent creeping, rigid roll type feed mechanism, and quiet operation.

Press is 7 ft 5 in. high; standard stroke of 2 in., maximum of 4 in.; 150 standard spm. Roll feed handles metal up to 13½ in. wide, and up to 3/16 in. thick.

Alpha Press & Machine, Inc, 9281 Freeland Ave, Detroit 28, Mich



SOLDERING IRON, Prest-O-Lite 406 Medium, is designed to handle all but the heaviest soldering jobs. Operating on acetylene, tool heats up in less than two min. It is available with interchangeable pointed or chisel-edge copper soldering heads—*Linde Air Products Co, 30 E 42nd St, New York 17, NY*



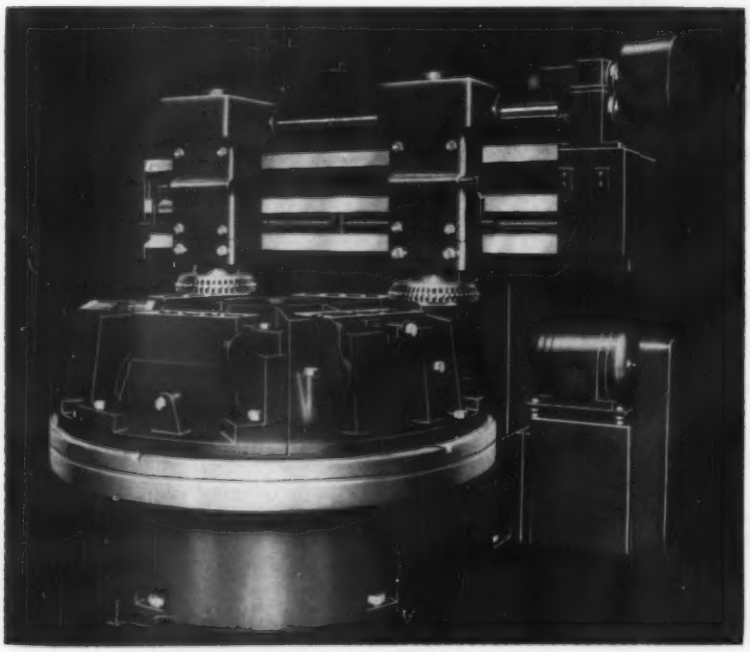
Torit Dust Collector Handles Eight Grinding Wheels at Once

Model 123 dust collector, the largest cabinet collector made by company, has a dust storage capacity of 10 cu ft and a filter area of 300 sq ft. Its 5-hp motor moves approx 2000 cu ft of air per min through an 8-in. inlet at speeds of more than a mile a min. Static pressure for this inlet is 3½ in. water. Unit reportedly can handle as many as 8 grinding wheels at a time.

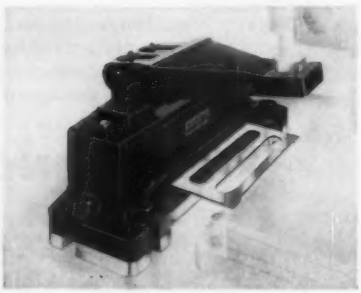
Motor is internally mounted in the clean air stream above the filters for cool, quiet operation. Cloth filters are chemically treated for spark resistance and sealed against leakage. Manual starter with overload protection is standard equipment; explosion-proof motors and magnetic starters are available at extra cost.

Unit is 115 in. high, 62 in. wide, and 26 in. deep. Price is $1198 fob.

Torit Mfg Co, Dept KP, 287 Walnut St, St Paul 2, Minn

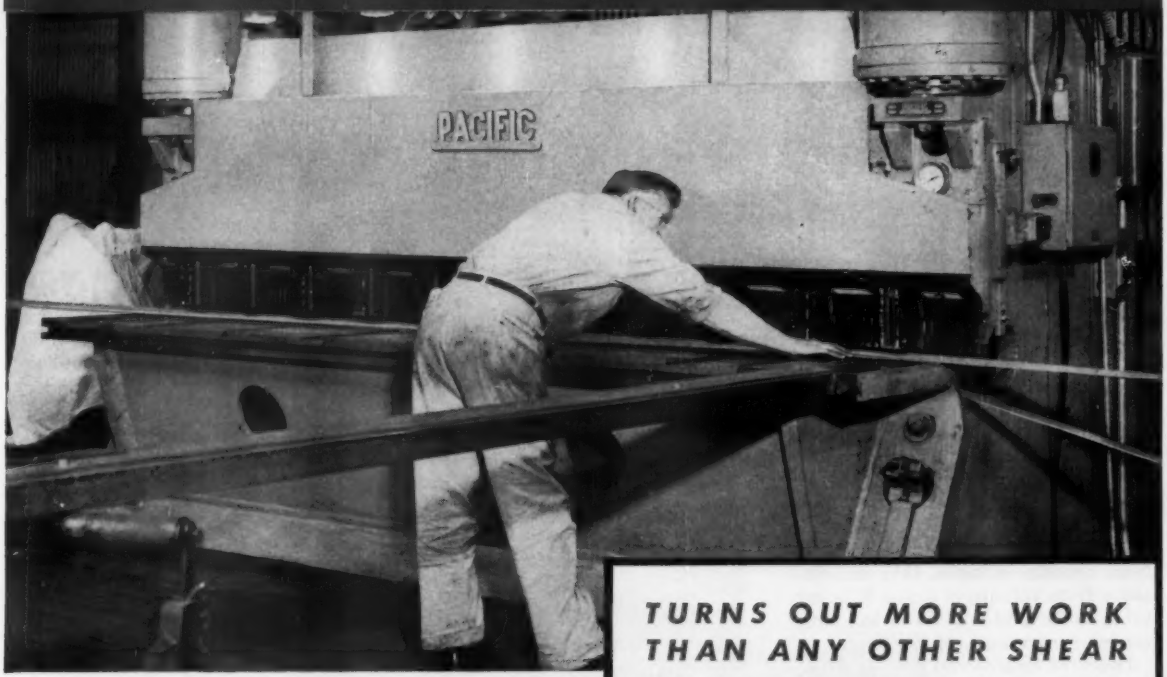


SPECIAL ROTARY MILLING MACHINE, designed for automotive industry, has circular table and twin spindles, and reportedly permits extremely accurate milling. Spindle heads are independently adjustable vertically and horizontally enabling operator to rough cut and finish in one pass, or to cut on two levels in two different cutting circles. Table, powered by variable-speed drive, can be set for speeds up to 100 iph. Dia of table is 72 in.—*Machine Tool Dept, Box 154, Hamilton Div, Baldwin-Lima-Hamilton Corp, Hamilton, Ohio*



SCRAP CHOPPER driven by punchpress ram can handle steel up to 12 in. wide and 3/32 in. thick. Device fits any punchpress and handles any coiled ribbon stock. Blades are quickly removable for re-grinding—*Jaco Devices, Inc, 90 High St, Hingham, Mass*

PACIFIC HYDRAULIC SHEAR cuts sheets or heavy plate noiselessly, accurately, at lowest cost



. . . knife blade lasts longer, shear cannot be damaged by overload

Lower cost shearing can be yours with this remarkably efficient shear that eliminates shock, the main cause of blade damage and wear. Pacific Hydraulic Shear gives you speed, accuracy, safety, economy and long, trouble-free performance. It cuts soft aluminum or polished stainless without marking . . . it cuts narrow strips or trims fine edges from plates or sheets. At a single setting of the blade clearance it cuts any piece between 20 gauge sheet and full capacity. Gap type shear cuts pieces far longer than the shear length. Simple hydraulic system eliminates troublesome maintenance of mechanical shears. For production or piece work, Pacific Hydraulic Shear can be the biggest profit-making tool in your plant.

Write for literature

TURNS OUT MORE WORK THAN ANY OTHER SHEAR

Pacific speeds set up, measuring, handling and the other necessary operations that take up 95% of cutting time. It is a one-piece, welded steel structure that provides the rigidity necessary to shear heavy plates accurately. Straight-line downward pressure from 2 hydraulic cylinders keeps the shear from twisting or deforming under heavy loads. Slide ways are exceptionally long and heavy so that blade clearance is precisely maintained under heavy loads. Unique hydraulic back gauges controlled from the front rapidly move into place and can be inched slowly into the exact setting within thousandths of an inch. Blade clearance is adjusted in less than 5 minutes by calibrated screw in front of machine. Hydraulic hold-down provides positive gripping of work piece. Pressure is adjusted in seconds to match any work.

Pacific Shear is operated by movable foot pedal placed wherever most convenient. Dual control pedal available. Shear cannot be damaged by overload. Operator cannot possibly get his fingers or hands under the knife. Movement of shear either in inching or cutting is instantaneously responsive to the foot control pedal so that the blade can never get out of control.

PACIFIC INDUSTRIAL MANUFACTURING COMPANY

848 - 49TH AVENUE • OAKLAND 1, CALIFORNIA

PLANTS: OAKLAND, CALIFORNIA AND MT. CARMEL, ILLINOIS

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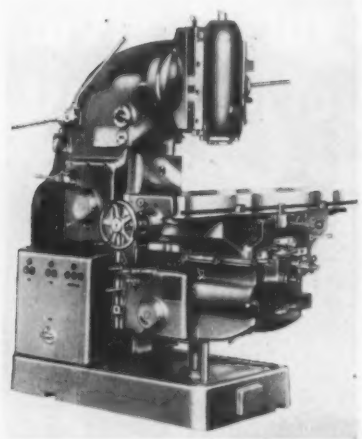


Maserati Miller Features Power Rapid Traverse in All Directions

Made in Italy by Maserati Machine Works, Model No. 3 miller has power rapid traverses in all directions, dual automatic selection of speeds and feeds, dual controls for all power feeds and rapid traverses, and dual controls for clutch and brake.

Other specifications: max distance from spindle to table, 18¼ in.; distance from column to brace, 31⅞ in.; table surface, 59 x 13 25/32 in.; table swivel (universal), 45 deg.

Imported by Maserati Corp of America, Westbury, LI, NY

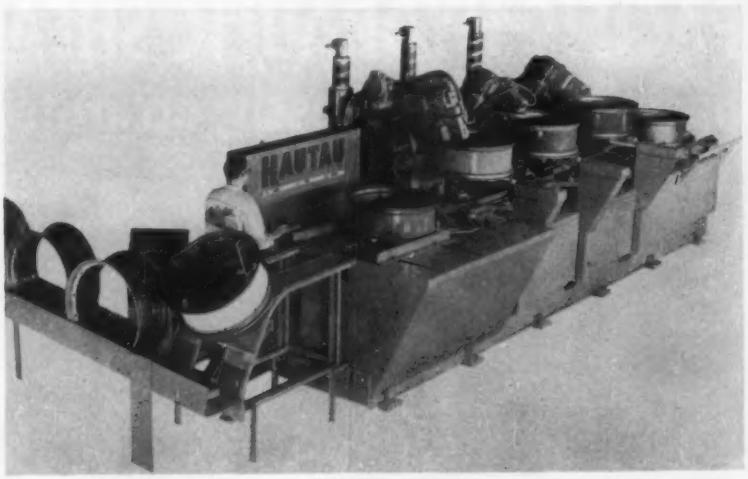
Thermistor-Actuated Device Will Limit and Control Temperature

The sensitivity of a thermistor bridge circuit is combined with the indicating and controlling function of a contact meter-relay in a temperature-control package which has been added to company's Simplytrol line of controls. Device reportedly will act upon a temperature change of as small as 0.075 F. The thermistor sensing elements can be located up to 200 ft from the controller.

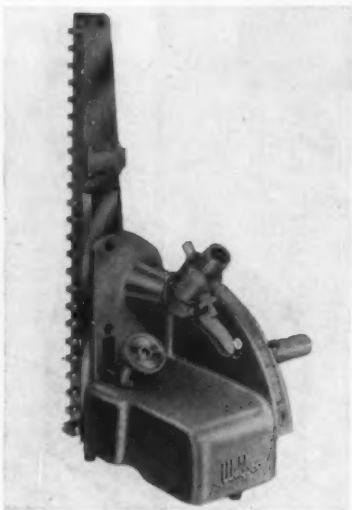
Control maintains temperatures at a given level by turning heating elements on and off. It will shut off or turn on something when temperature rises to (or falls to) a certain point, thus functioning as a limit or alarm control. Device can also be used as a cycling temperature control between two limits.

Models are offered in a number of temperature ranges, beginning with a minimum span of 15 F spread over a full meter scale of 95°. Controls have indicating accuracy of ± 2% of the span of the meter.

Assembly Products, Inc, Chesterland, Ohio



LARGE WHEEL RIMS are embossed, pierced and chamfered on 5-station work handling machine consisting of three 50-ton hydraulic presses and an in-line transfer mechanism. Rims are elevated to loading station by mechanical loader and are shuttled through machine by traveling carriage. Power clamps hold work in all stations; presses emboss at station 2, pierce valve stem hole at station 3 and chamfer at station 4; 1 and 5 are loading and unloading stations. Approximately 400 rims per hr are produced—*Hautau Engineering Co, 721 Wanda, Ferndale 20, Mich*



Webber Optical Height Gage Can Measure to 0.000025 in.

New optical height gage, the Micro-Accurate, reportedly permits fast measurements up to 61 in. with accuracies of ± 0.000005 in. per in. of height. It combines company's gage blocks and the Leitz measuring microscope. Basically, unit consists of a stack of gage blocks held together by spring tension.

The stack, which is made up of alternating .300 and .700-in blocks, is divided into 1-in. measurements by protrusion of the .300-in blocks beyond the .700-in. blocks. Blocks are raised and lowered over 1-in. range by means of a lever-operated cam and a vernier hand wheel. Readings are taken with the Leitz optical eye-piece.

Base is heavy Meehanite casting. Unit is available in four models, measuring to heights of 25, 37, 49, and 61 in.

Webber Gage Co, 12912 Triskett Rd, Cleveland 11, Ohio

Redesigned Germanium Rectifier Offered in Three Models

Designed for small or big-shop use in electroplating, anodizing, and related processing, Powertron rectifier is offered in self-contained models with ratings of 750, 1500, and 3000 amps. Voltage range extends from 2 to 12. Models are priced at $995, $1450, and $2695.

Units offer several improvements over earlier models, including the use of new germanium junction diodes and a dc protection system that requires no fuses. For the ratings offered, an arrangement of one germanium diode per phase is possible and there is no paralleling of junctions, providing good balancing of diodes.

Hanson-Van Winkle-Munning Co, Church St, Matawan, NJ

Hamilton press line expanded to include medium size presses

Pictured above is a new Hamilton Gap Press recently installed at the Eaton Manufacturing Company, Cleveland, Ohio. This new large-bed press stamps out the larger grille guards which the latest model cars are calling for.

The capacity of this press is 250 tons and the speed 28 to 30 strokes per minute. Bed area is 90 in. right to left; 36 in. front to back. It is one of a new line of single and double-crank presses ranging from 100-300 tons capacity.

Write to Hamilton Division, B-L-H Corporation, for full information and specifications on this new line of heavy duty Hamilton presses.

Hamilton Division Hamilton, Ohio

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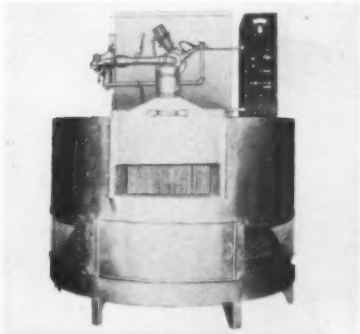


Grieve-Hendry Rotary Oven Speeds Work Handling

Built to permit loading and unloading from the same position by a single operator, rotary-hearth oven permits a continuous movement of work in and out of the heating zone. Standard speed range from 2 to 10 ipm, or approximately 1 to 5 revolutions per hr, makes oven practicable for processing many types of products.

No doors are used. An alloy-steel chain curtain is used to conserve heat and furnish convenient access to the work chamber. Ovens are built to individual requirements; unit illustrated has inside working space 14 in. wide by 9 in. high by 150 in. long on an OD of 54 in., an ID of 26 in. Maximum working temperature is 1000 F.

Unit comes completely assembled and mounted on legs to provide 30-in. working elevation. Other features: 125,000-btu burner; 500-cfm steel-plate recirculating blower; indicating temperature controller; combustion safety controls with pushbutton electric ignition. Unit is also available with electric heating units.

Grieve-Hendry Co, Inc, 1401 W Carroll Ave, Chicago 7, Ill

Stueck Friction-Cut Bandsaw Offered in Three Models

Available in three models and different speeds for cutting a variety of materials, bandsaw trademarked Connecticut features friction cutting, which is reported to produce smooth, accurate edges. Ferrous materials such as mild steel, stainless steel, and hardened steel (¼ in. thick or less) can be handled on the machine, as well as some non-ferrous metals, such as monel.

General specifications for the models: throat depth, 24 in.; cast-iron table, 20 x 22 in.; max height under guide, 10¾ in.; max blade width, ¾ in.; motor, 1-hp/1800 rpm. A 45° tilting table may be added to any model as an extra.

Model A-24-S is a single-speed unit (anywhere between 1860 and 6000 fpm) for wood, plastic, non-ferrous metals, and friction cutting. Model A-24-3 offers 3 fixed speeds: 150 fpm for sawing heavy mild steel, 640 fpm for stack-sawing galvanized sheets, and 4870 fpm for sawing lighter materials. Third model, A-24-V, features a 3-range variable-speed drive: 58-173 fpm for tool steel and heavy mild steel; 244-730 fpm for heavy non-ferrous materials and stack-sawing galvanized steel sheets; and 1822-5460 fpm for lighter materials.

W Whitney Stueck, Inc, Old Saybrook, Conn

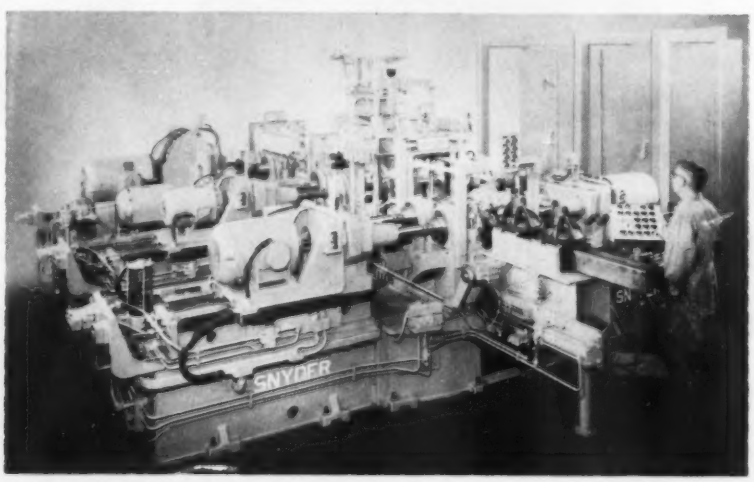
Pantograph selector chart determines correct pantograph ratio and proper width of cutter when engraving letters with specified height from single line master. It is made of plastic and sells for $1.00.

H P Preis Engraving Machine Co, 204 Industrial Branch, Hillside, NJ

Tube and bar cutter has automatic feed and will cut ⅜-in. dia tube and 1/16-in. dia rod in brass, steel and plastics with an accuracy of ± 0.003. Unit is powered by two ¼-hp motors and compressed air.

Click Industrial Automation, 2385 Jerome Ave, New York 68, NY

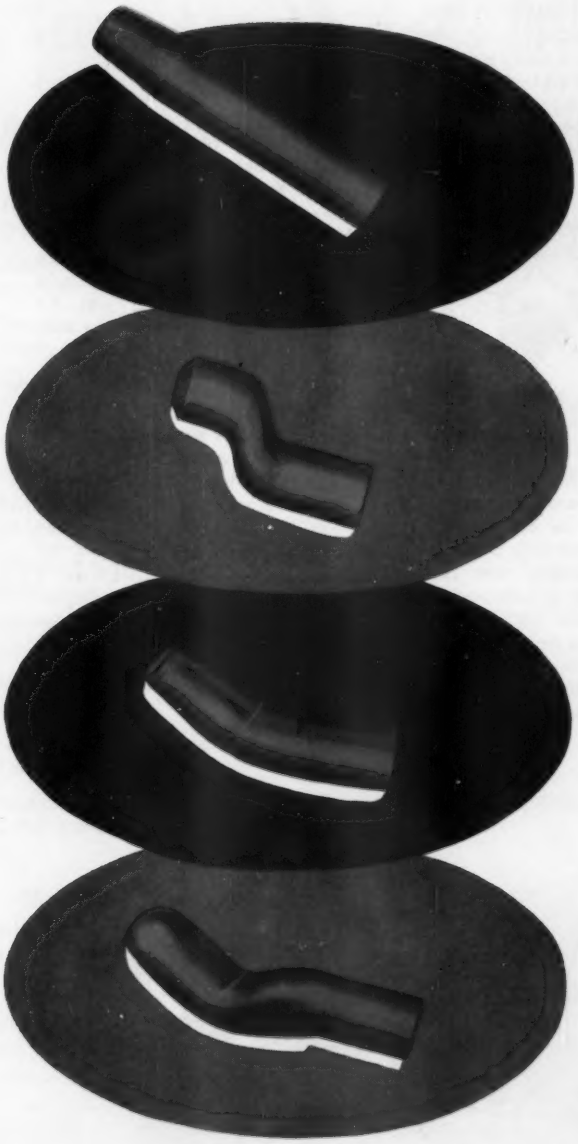
INDEXING ROTARY TABLE, called Rotodex, has simplified indexing attachment. In 10-in. circle, angle accuracy between one division and the next is accurate within 0.0003 in. Indexing attachment reportedly eliminates miscounting of turns and incorrect dial readings — *Genevamatic Engineering, 404 E Ellamae, Tampa, Fla*



AUTOMOTIVE DIFFERENTIAL CARRIER AND CAP ASSEMBLIES are machined on in-line transfer machine at the rate of 180 pieces per hr. The 7-station machine, hydraulically operated and electrically controlled, rough-bores two carrier bearing holes, loosens and tightens four bearing-cap bolts, semi-finish-bores the two bearing surfaces, and taps each bearing. Parts are transferred in pairs by transfer mechanism. Special loosening and tightening stations relieve machining stresses of assembled parts in process—*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*

If You Use Resistance Welding...

Take A Tip From Mallory



Mallory resistance welding electrodes are available in the widest variety of stock sizes and shapes to be found anywhere. Many of the Mallory standards can actually eliminate the need for costly special electrodes. Constant Mallory research and pioneer background in the field of alloys continues to contribute increased life and better performance to a growing number of diversified users.

FAST DELIVERY is a product of a large and well rounded stock of standard electrodes. Mallory's diversified stock enables changeover and replacement units to be shipped to you on short notice.

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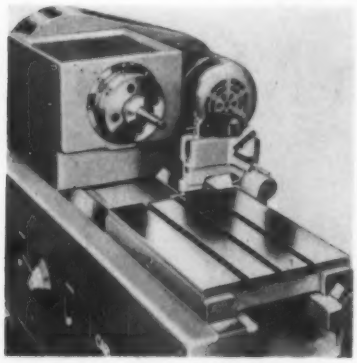
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

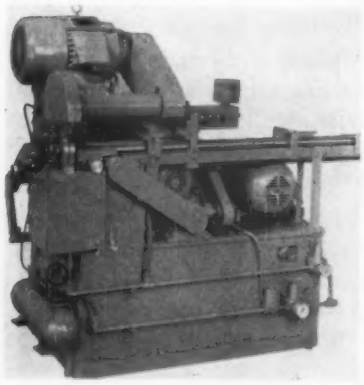


Measuring Device Speeds Adjustment of Boring-Machine

Larson precision boring machine, a product of Sweden, is a single-end unit with wide capacity designed for production operations. For swift and exact cutter adjustment, a dial indicator is provided with an accuracy of 0.001 in.

Other features: variable spindle speed; air-cooled, totally enclosed electric motors; vibrationless boring spindle; transmission with endless pulley; simplified construction.

Imported by Aaron Machinery Co, Inc, 45 Crosby St, New York 12, NY



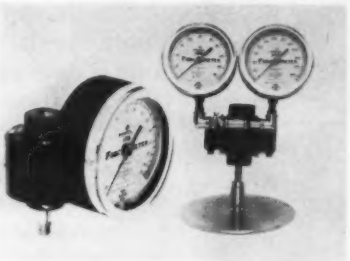
Porter Cutoff Saw Handles Small, Non-Ferrous Stock

Designed for high production, No. 163 cutoff saw is adaptable to round, square, or rectangular sections (solid or hollow) up to approximately 2-in. maximum dimension. Machine can trim two bars simultaneously.

Stock is placed on a belt conveyor that is long enough to support and feed incoming bars. Movements of gaging, clamping, and saw feeding are cam actuated from a single camshaft. The belt, which runs continuously, feeds stock forward to adjustable end gage, clamp lowers, saw lowers and raises, clamp releases, and finished parts drop as stock feeds forward for next cycle. Unit is reported capable of sawing 1¼-in. solid aluminum rounds at the rate of 4200 per hour with length tolerance of ± 0.005 in.

Machine features clamping on both sides of cut for rigidity. 5-in. saw collars used with 10-in. saws provide maximum stiffness. Ball-bearing construction is used throughout.

Burke E Porter Machinery Co, 730 Plymouth Rd NE, Grand Rapids 5, Mich

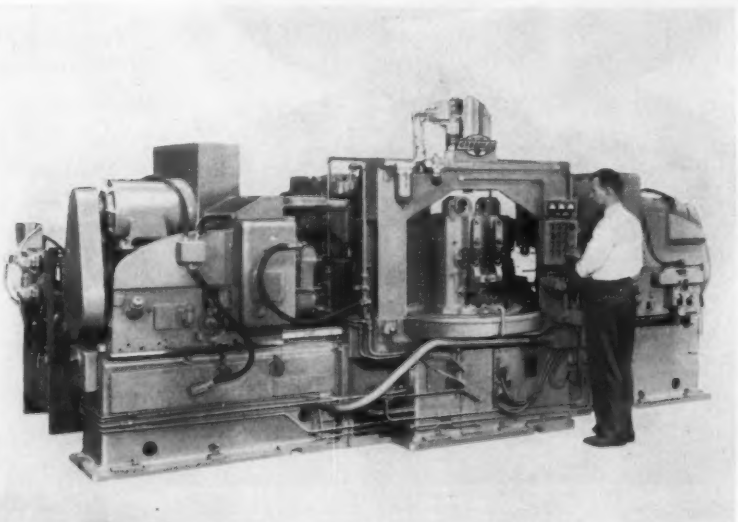


INDICATING DEVICE called Forc-Ometer measures any mechanical load, force or thrust by converting it to a proportional hydraulic pressure. Diaphragm-type assembly does converting, and pressure is indicated on dial-gage face. Model 150 is available with total ranges from 15 to 100 lb; model 300, with total ranges from 50 to 600 lb—*Charles W Schneible Co, 32 Lee Court, New Rochelle, NY*

HONING LAPS in Macolaepp line are reported suitable for use on tool steels and the hardest carbide tools. Tools are reported to provide 95% of the hardness of diamond at 1/3 the cost. Mounted on a handle, laps are available in any of four different grits for light to heavy honing jobs—*Air Transport Equipment, Inc, Albany Ave, Amityville, NY*

Epoxy resin adhesive, EC-1469, reportedly has high shear strength at bond temperature of 300 F, and high resistance to water and salt spray. It can be cured with or without catalyst, has service temperature range of –65 to +300 F, and is suited for honeycomb applications. No volatile by-products are given off, so unperforated honeycomb material may be used.

Adhesives and Coating Div, Minnesota Mining and Mfg Co, 411 Piquette Ave, Detroit 2, Mich



DIESEL CONNECTING RODS are machined on 3-way, 4-station, horizontal, automatic indexing machine which produces 84 rods per hr at 100% efficiency. Wrist pin holes are drilled and cap side of crankshaft hole is bored at station 2; rod end of hole and bolt bosses are bored at station 3; wrist pin holes are semi-finished reamed and cap and rod are separated at station 4. Unit has automatic lube and chip disposal systems—*Greenlee Bros & Co, Rockford, Ill*

CLEEREMAN

"Series A" *Automatic* Drilling and Tapping Machines

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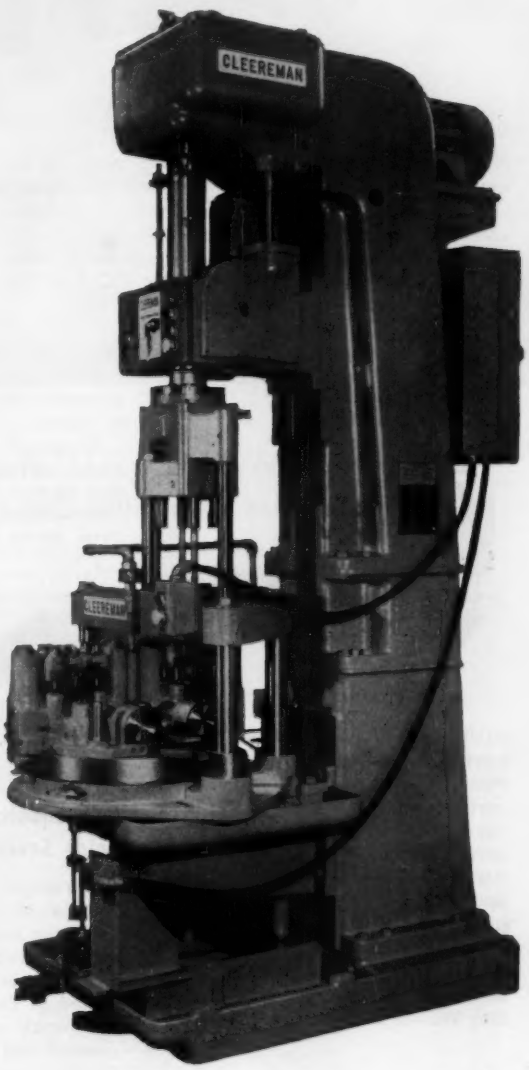
San Francisco, Calif.
Chas. M. Bailey Co.

South San Francisco, Calif.
Smith-Blair Co.



These are a few of the Cleereman "Series A" users who find this "box cycle" automatic Drilling and Tapping Machine the answer to their problems.

Drilling and tapping a hole "at the touch of a button" produces faster, easier and at highest profits. Operators are relieved of handling cumbersome controls. Operator morale is boosted and operator fatigue reduced.

Join the rapidly increasing Cleereman "Series A" users list. This fast set-up production-type drilling and tapping machine has a place in your plant. Don't delay increasing your production efficiency. *Wire, write* or *phone* about your jobs right now.

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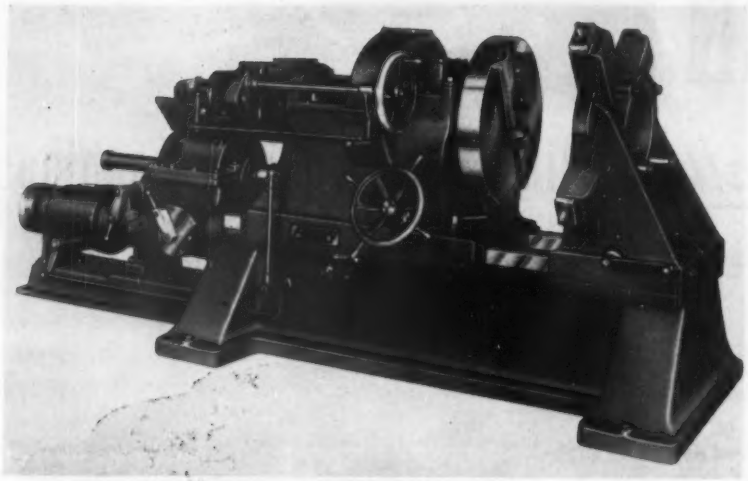
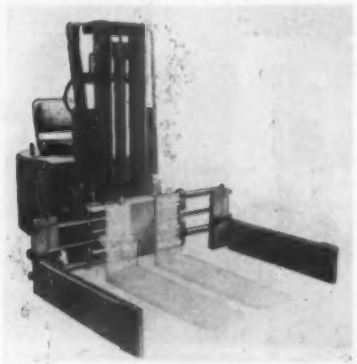


PIPE AND FLANGE FACING MACHINE, made for manual or electric-hydraulic automatic cycle operation, can accommodate diameters from 2 to 24 in. With various fixtures and rotary tables instead of the steady rest, it can face flanged valves and fittings from 2 to 36-in. dia. Each machine can be tailor-made for specific operations. Multiple heads can be provided for performing several operations simultaneously—*Forney's Inc, PO Box 310, New Castle, Penna*



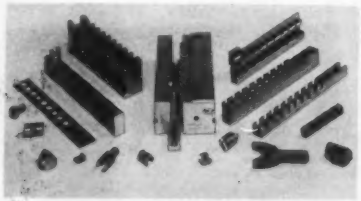
ADJUSTABLE CLAMP attachment, known as Cascade, fits company's Master line of trucks. Trucks may be used for palletless handling by clamping the load, or for pallet loading by using clamping arms as forks. Clamping arms rotate 90 deg to permit both operations. Used as clamp, max adjustment is 63¾ in. between arms, and minimum is 16 in. Pallets 30 in. wide may be handled. Arms are rubber-lined. — *Lewis-Shepard Products, Inc, 688 Walnut St, Watertown, Mass*

Carmet Toolholders Designed For Throwaway Carbide Inserts

New holders are available in more than 90 styles and sizes. They permit easy indexing of the carbide tips and feature a gripping design that exerts cutting pressure in same direction as clamp screw. Screw is accessible from both top and bottom of holder.

Holders are cadmium plated to resist corrosion and have replaceable carbide chip breakers.

Carmet Div, Allegheny Ludlum Steel Corp, Oliver Bldg, Pittsburgh, Penna

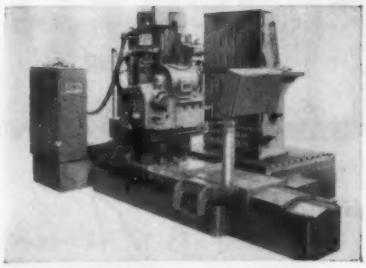


Dery Equalizing Gang Vise Holds Several Small Workpieces

Tailor-made to speed precision machining of small parts, equalizing gang vise consists of a solid jaw and a body which holds a series of equalizing pads or blades. The solid jaw is locked to the body with screws and the work is inserted. The "V" grooves and the equalizing pad thus form a 3-point chuck for each workpiece.

Pieces with a diameter variance can be milled simultaneously, because the equalizing blades will "give," allowing each piece to be held firmly.

Also available for use with the



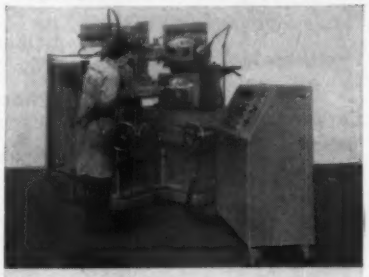
A P&W *Tracer-Controlled* MILLER FOR EVERY JOB

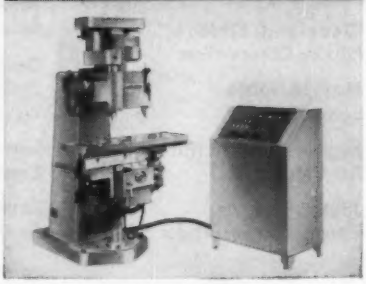
KELLER Type BG-21

. . . A powerful, versatile machine made in a range of sizes from 5' x 2½' to 10' x 4' in single spindle or 2-spindle models.

KELLER Type BL

. . . A compact powerful Tracer-Controlled Miller for work within the range of 36" x 20", with all the new KELLER features. Single spindle and 3-spindle models.



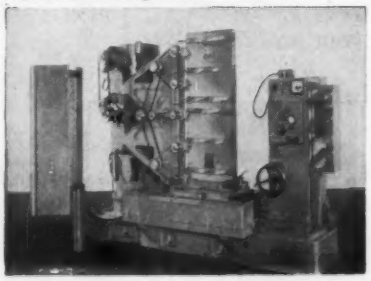


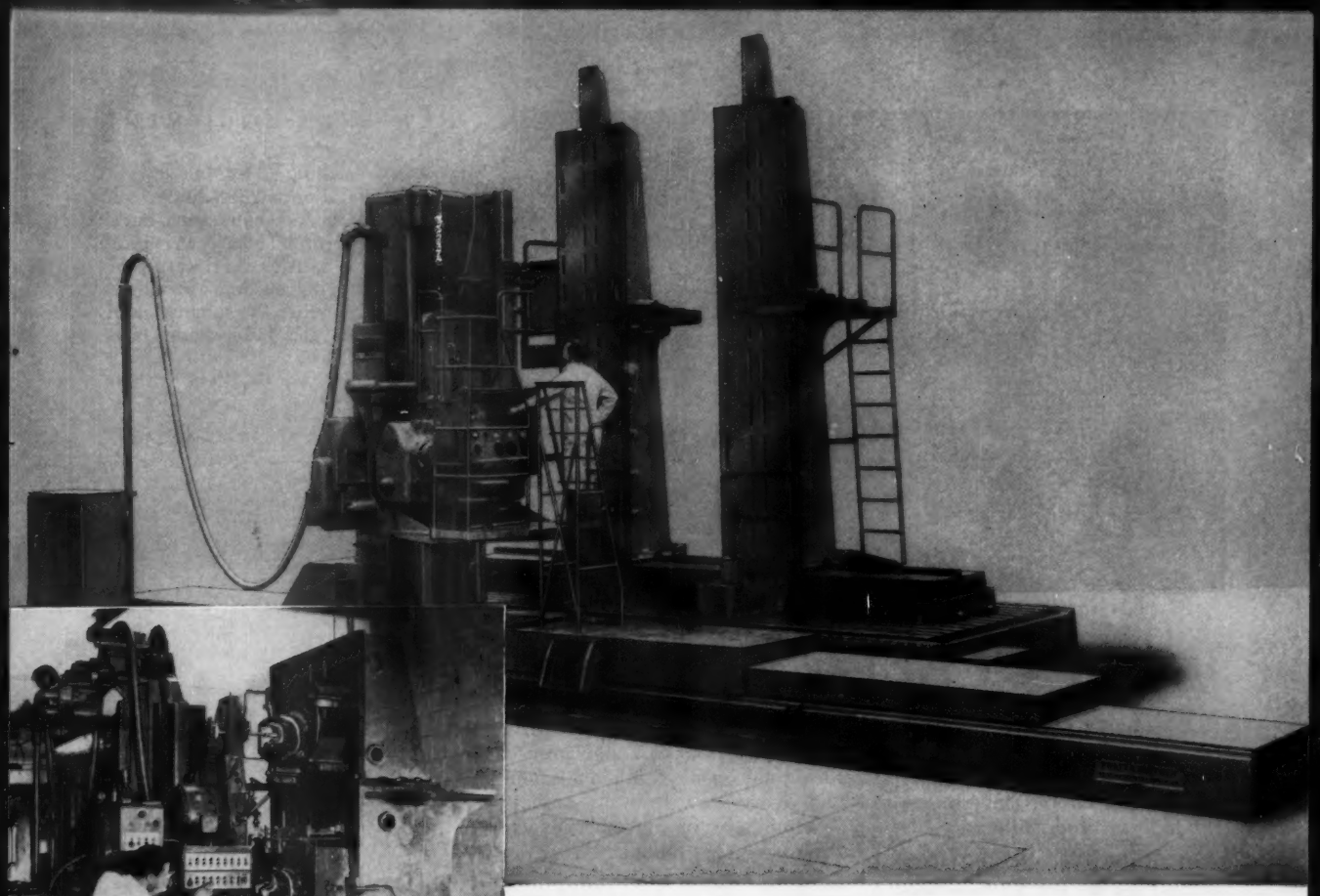
VELVETRACE® Kellering Machine

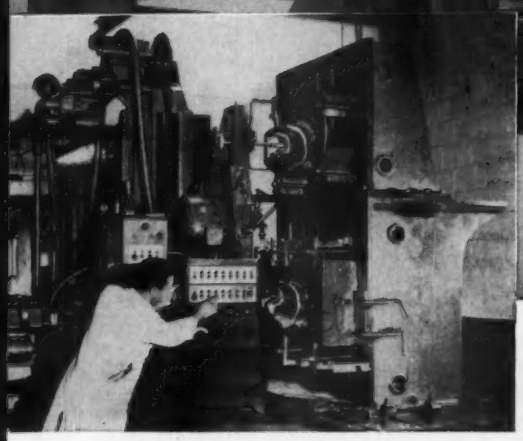
. . . Duplicates the finest detail with extreme precision. New, non-contacting tracer accurately follows any 3-dimensional model without touching it. Cannot damage the softest, most fragile models.

Automatic Duplicating Machine

. . . Specially designed for low cost production of forging dies and molds for glass and plastic. Automatically re-produces original dies and molds with precision and remarkable detail. There are two versions of this machine, one for machining bottle molds, one for forging dies. Supplied with 1, 2 or 4 cutter spindles.







Still Running Fine, BUT

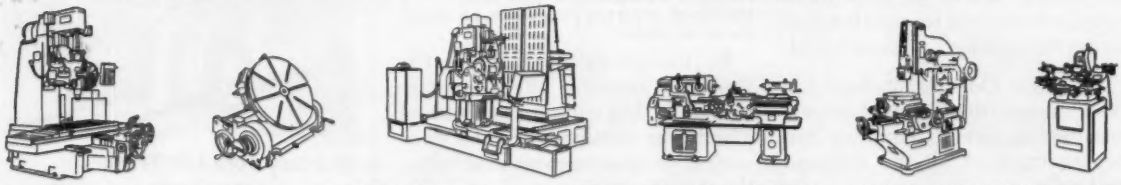
TODAY'S KELLERS WILL BRING EVEN GREATER PROFITS.

You may put off replacing an older machine because "it's still paying its way." But is it? A machine tool purchased years ago may be the cause of lost efficiency, higher labor and per-unit costs, the inability to produce high quality *economically.* Failure to compete profitably with more modern machines may be putting you far behind your competitors. For example, just 10 short years ago our Keller BG-2 Tracer-Controlled Miller was the ultimate in productive efficiency, but let's check the added features possessed by its successor, the new P&W BG-22 Keller . . .

1. Operates from any conventional polyphase current, with no motor generator set required.
2. Increased travel speed of cutting tool . . . to an infinitely variable range from 0.5 to 30.0 inches per minute.
3. Three dimensional tracer permits motion in 2 directions at the same time, yet allows interlocking action for accuracy. One slide is kept always in motion, while the second moves as required to follow the shape and maintain accurate interlocking action.
4. More nearly perfect surface cutting speed over irregular contours assured through superimposed auto-speed control of all motions.
5. Increased capacities . . . up to 20 feet horizontal x 7 feet vertical.
6. Centralized operator controls supplemented by remote control stations.
7. Rapid traverse in all three motions.
8. Automatic lubrication.
9. Score-proof phenolic bearing surfaces on all slides and lead screw nuts.

Write for complete information.

Pratt & Whitney Company, Incorporated
11 Charter Oak Boulevard, West Hartford, Conn.

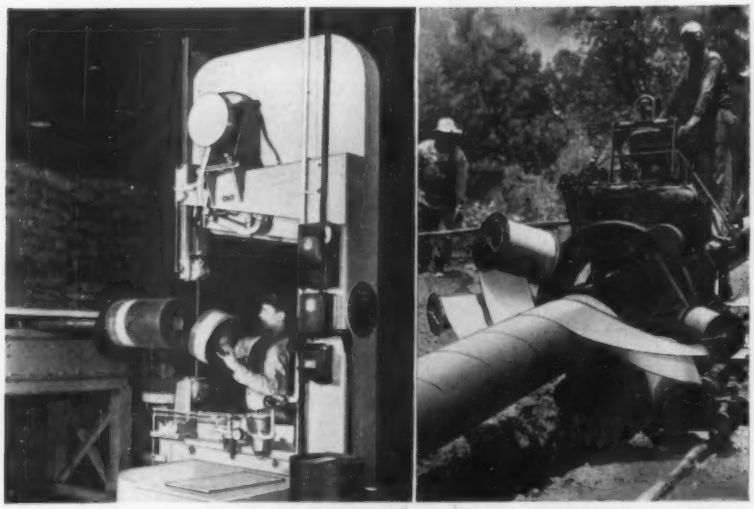


JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



CUTTING COSTS in the pipe wrapping business . . .

What's Cooking in Tools

A young homemaker puts a roast into her automatic oven . . . and, unknowingly, reaps the harvest from a tremendous investment in the tools of production.

The picture of the pipeline that brings gas to her kitchen tells a story of "tools"—tools to make, transport, wrap and lay the pipe.

In the picture, the pipe is being wrapped with plastic-impregnated fibre glass sheeting to protect it against corrosion. Rolls of wrapping must be supplied in a great many widths to meet individual requirements. Manufacturing and warehousing the many different rolls was a costly and complex problem —until a special tool was built and put into service.

Now, the rolls are made and stocked in one width only, then cut quickly and economically to customer's order. A motorized mandrel feeds them into the high speed, continuous-cutting DoALL band saw shown above. It cuts them smoothly to desired length almost as fast as you can slice a piece of bread.

The single DoALL machine has saved many manhours formerly consumed in making, handling and keeping track of all the different sized rolls.

All through industry there is urgent need for more and more of such time, money and man-saving tools if we are to continue to have an abundance of conveniences and comforts. U.S. population is expected to increase 20% during the next ten years, while the work force will increase only 6% (and people hope before long to work as few as 30 hours per week). In face of this, management of manufacturing plants must establish entirely new goals for investment in tools to increase human productivity.

From a kettle on the hearth, to a woodstove, to an automatic gas oven . . . a parade of progress created by an abundance of tools.

In the realm of sawing, The DoALL Company offers industry new tools that will do thousands of jobs faster than they can be done with any other machines, including those costing far more.

Reprints of this series on economics available for your employees.

FREE DEMONSTRATIONS of totally new types of DoALL band-sawing machines will be made at any plant upon request. Call DoALL locally or write.

The DoALL Company
Des Plaines, Illinois
38 Local Sales-Service Stores E-15

vise are loading slides for use in milling operations. These slides can be made with slots, holes, pins, keys, and counterbored holes for holding the parts as well as for locating or indexing for the milling operations.

Company invites the submission of specifications for tailor-made jaws for holding parts.

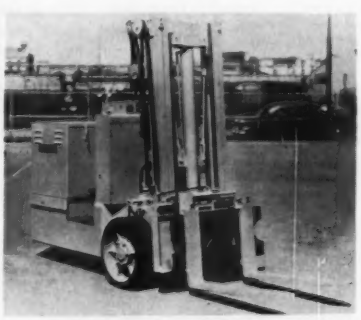
Dery Tool & Die Co, Main St, Pine Meadow, Conn

Unipunch Hole Punching Unit Is Completely Self-Contained

Unipunch Series G units have no parts attached to press ram. Punch and die are held in Meehanite holder. Interchangeable die buttons fit into die adapter.

Punch has shut height of 7½ in., 3⅛-in. die height for holes up to 0.3125 in. diameter in mild steel up to ⅛ in. thick. Throat depth is 3 in.

Punch Products Corp, 3800 Highland Ave, Niagara Falls, NY



Mercury Fork-Lift Truck Features Short Turning Radius

Model A-1484 stand-up fork truck, trademarked Yak, has 4000-lb capacity with loads up to 48 in. long. Travel speed is 6½ mph with no load

Put HOWELL in Your Product Picture

...and gain the

PLUS values in power

that count!

Are you selecting punch press motors that must "live in" and like the hot spots high up under factory roofs? Want a motor that's built to fill the constant stop-and-start requirements of heavy-duty machine tool service, yet be as good looking as tomorrow's most streamlined and automated machines? Then specify Howell, as machine tool builders and plant engineers throughout the metal working industry have been doing for years. Among many good reasons are these:

EXTRA DEPENDABILITY that challenges the years. Howell's new principle of heat-source ventilation . . . double sealed bearings . . . tough rolled steel frames and precision fitted cast iron end plates . . . these and many more are plus values that *count!*

AN UNSURPASSED REPUTATION for engineering excellence and quality manufacture . . . built up by Howell in over 40 years of serving industry's motor requirements.

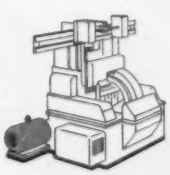
TOPS IN APPEARANCE. No other industrial motors have such smooth, unbroken contours . . . without a fin or rib to mar their looks or catch dust deposits.

Howell makes virtually every type of AC industrial motor, fractional and integral to 300 hp, in all standard enclosures, in rerated and non-rerated frame sizes, also a wide range of gearmotors and brake motors.

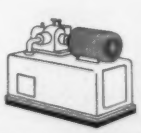
among leading machine tool manufacturers who use Howell motors are these:

The Cross Co. • E. W. Bliss Co. • Warner-Swasey Co.
Snyder Tool and Engineering Co. • The Carlton Machine Tool Co.
The Cincinnati Milling Machine Co. • Sundstrand Machine Tool Co.

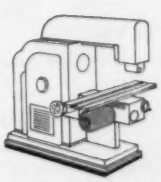
GRINDERS



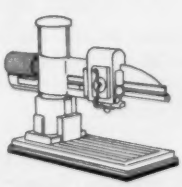
LATHES



HYDRAULIC SYSTEMS



MILLING MACHINES



RADIAL DRILLS

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL *motors*

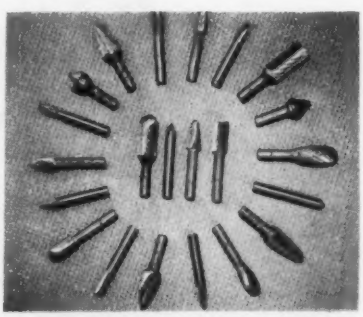
. . . precision built for industry since 1915

and 5¾ mph with full load. Hoisting speeds are 45 fpm with no load, 30 fpm with full load. Maximum fork elevation is 130 in. (61 in. non-telescopic).

Truck can stack at right angles in an aisle equal in width to 102 in. plus load length.

Truck is powered by 18 cells of 19-plate lead-acid battery, 30 cells of MC-8 nickel-alkaline battery, or HA-36 Ready Power unit. A 4-speed travel control is provided.

Mercury Mfg Co, 4044 S Halsted St, Chicago 9, Ill



Tool Has Right-Hand Double Cut and Left-Hand Spiraled Tooth

Severance Ecarno-Mill, featuring a right-hand double cut with a left-hand spiraled tooth, reportedly produces smooth, balanced, cutting action.

Made of solid carbide, it is recommended for working materials beyond scope of regular high speed steel rotaries, in applications such as die, mold and pattern work, deburring, blending, and elongating.

Tool reportedly will work abrasive plastics, aluminum, magnesium and similar materials.

Severance Tool Industries Inc, 726 Iowa St, Saginaw, Mich

Worthington Air Chillers Reduce Moisture in Compressed Air

Designed to prevent rusting and damage from water carried through tools in the form of droplets, packaged air chiller can be used with such tools as pneumatic devices, presses, and stampers. Unit is a complete refrigeration system consisting of a refrigerant compressor, motor, condenser, expansion valve, and chiller.

In operation, air enters the chiller by way of an air inlet, where it is then circulated through the chiller by means of baffles. As the air is

This 5000-ton Farquhar Split-Die Forging Press is used to form components of oil-well control equipment.

This Farquhar Split-Die Forging Press

forms both bore and periphery in one fast, clean operation

The job was to press-forge parts weighing up to 2000 pounds having irregular contours on both the bore and the periphery. These parts in service had to withstand working pressures up to 15,000 pounds per square inch and temperatures up to 1600 degrees F. The successful solution was to put the job on a Farquhar Split-Die Forging Press.

This Farquhar Split-Die Forging Press applies horizontal forces from opposite directions as well as the normal down-action. The result is the production of high-strength parts with unusually clean surfaces whatever the contour. This cuts finish machining time to a minimum and provides forgings with uniform physical properties and controlled grain structure. Reported production savings run as high as 25% with rejects kept to a minimum.

For your tough forming jobs, investigate Farquhar Split-Die Forging Presses. Write today for complete information or ask for our recommendations and proposals.

Special Machinery Built to Your Requirements . . .

Our skilled staff will economically build your special machinery. We'll process your inquiry promptly.

A. B. FARQUHAR DIVISION
The Oliver Corporation
Press and Special Machinery Department
York 15, Pennsylvania

OLIVER Farquhar PRESSES

Also Manufacturers of Farquhar Conveyors

IN FLATWARE, TOO, Sharonsteel Quality STANDS OUT

A thorough knowledge of flatware manufacture — uncompromising adherence to analysis specifications — plus, the industry's finest finishes are reasons why so many of the nation's leading stainlessware makers demand Sharon Quality Stainless Steels.

SHARONSTEEL

For 56 Years a Quality Name in Steel

SHARON STEEL CORPORATION, SHARON, PENNA.

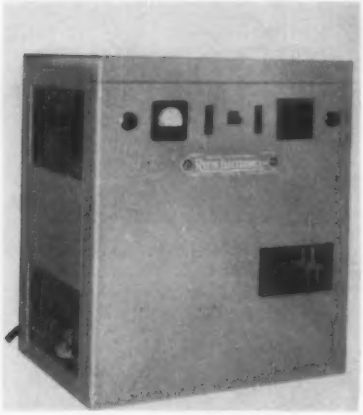
165

CHICAGO, CINCINNATI, CLEVELAND, DAYTON, DETROIT, GRAND RAPIDS, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, NEW YORK, PHILADELPHIA, ROCHESTER, SAN FRANCISCO, SHARON, MONTREAL, TORONTO

refrigerated, the moisture vapor in the air is condensed and drains from the chiller by way of sump and trap. The dry or dehumidified air leaves the chiller through the air outlet and is then delivered to the pneumatic tools.

Company can design units with as little as 1 lb per in^2 air-pressure drop through the chiller, thus effecting power savings.

Worthington Corp, Harrison, NJ



Reeve Induction Heater Can Be Used for Soldering, Hardening

Bench-mounted unit designated Model L6E is latest addition to the Reevelec line of R-F induction and dielectric heaters. It can be used for soldering, brazing, hardening, annealing, and other production operations.

Heater features a built-in output transformer, built-in automatic recycling heat cycle timer, circuit breaker protection, protective interlock switches, and a forced-air cooling system.

The 2-kw unit weighs about 200 lb and measures 28 in. high, 25 in. wide, and 18 in. deep.

Reeve Electronics, Inc, 609 W Lake St, Chicago 6, Ill

Coating unit, Mark III, is mobile and can be used for both dip coating and spray coating of polyethylene powders to metal. It has metal reservoir hopper 15 in. in dia and 24 in. deep in powder bed. Unit is equipped with 15 ft of air and powder feed hose, and aluminum spray gun. When used for dip coating, nylon and fluorcarbons can be applied by unit.

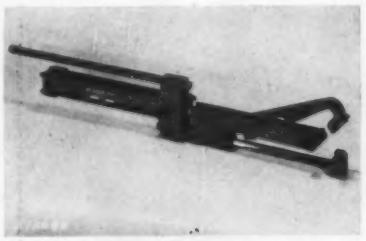
American Agile Corp, 5461 Dunham Rd, Maple Heights, Ohio

Brady Lightweight Coolant Pump Delivers up to 500 gpm

Model 505-T coolant pump and tank, designed for either portable or permanent coolant supply for small or medium size machine tools, weighs 27 lb and pumps from 1 to 500 gpm of light oil or soluble compounds.

Unit is equipped with built-in baffle and has capacity of 6 gal. Standard unit operates on 115-v, 60-c, 1-phase current, but 230-v model is available. Supplied with two 8-ft lengths of hose and nozzle, pump is ready to plug in and use.

Brady Pump Corporation, Muncie, Ind



JAW ASSEMBLY fits conventional air-powered straight-line or swinging-arm type press unloader and will unload stampings having a vertical flange at point of pickup. Heavy-duty air cylinder opens and closes jaw. Nylon or neoprene jaw inserts can replace standard steel buttons. Model 715 has 7-in. stroke, 1½-in. dia cylinder; model 820, an 8-in. stroke, 2-in. dia cylinder. Both have 1¼-in. jaw opening — *Press Automation Systems, Inc, 18616 Wyoming Ave, Detroit 21, Mich*

General Electric Welding Controls Feature Plug-In Components

Line of non-synchronous resistance-welding control panels, which meets all NEMA performance standards and can be readily modified to meet JIC enclosure specifications, features unitized plug-in control units, her-

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES

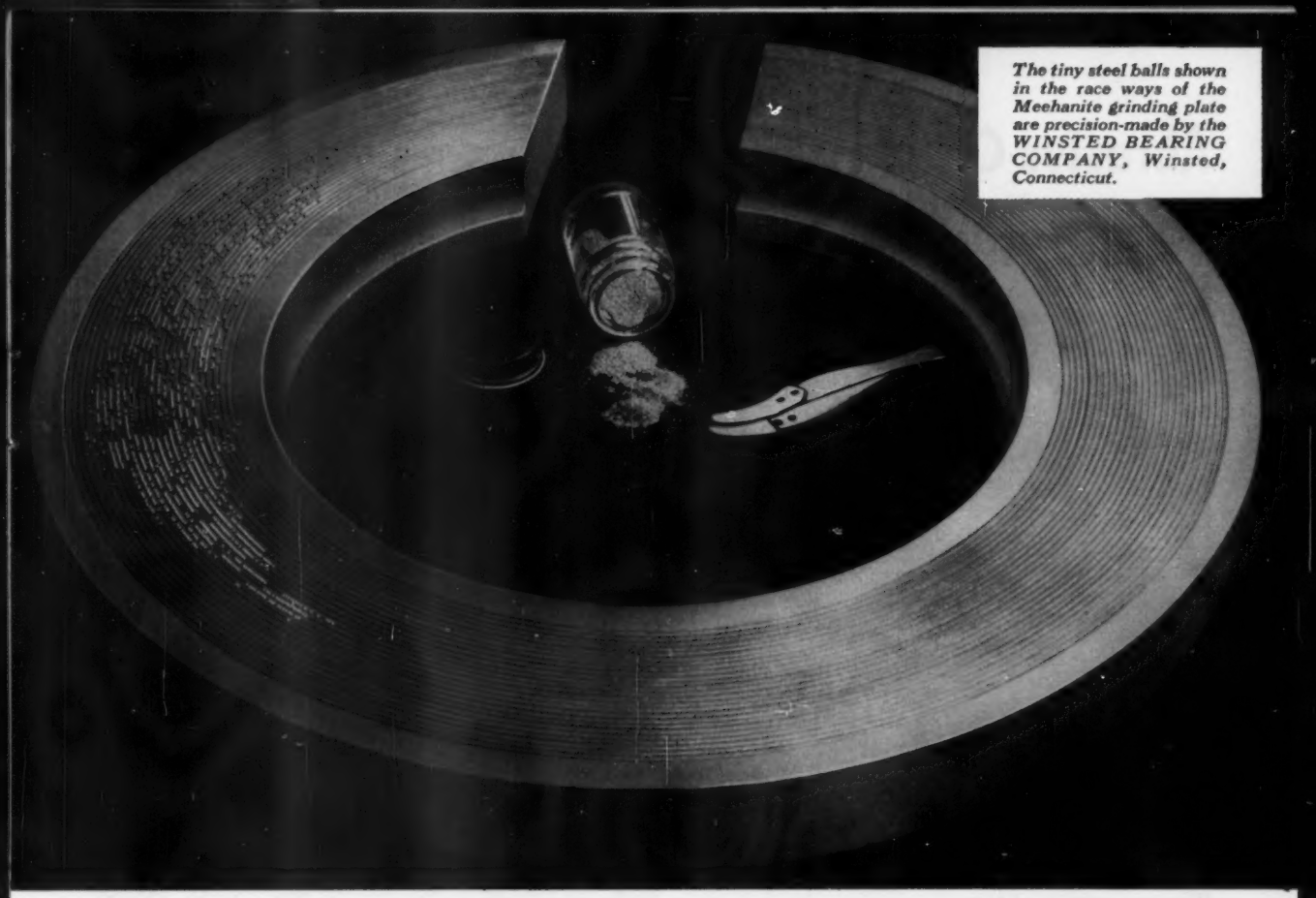
The American Laundry Machinery Co., Rochester, N. Y.
Atlas Foundry Co., Detroit, Mich.
Banner Iron Works, St. Louis, Mo.
Barnett Foundry & Machine Co., Irvington, N. J.
Blackmer Pump Co., Grand Rapids, Mich.
Centrifugally Cast Products Div., The Shenango Furnace Co., Dover, Ohio
Compton Foundry, Compton, Calif.
Continental Gin Co., Birmingham, Ala.
The Cooper-Bessemer Corp., Mt. Vernon, Ohio and Grove City, Pa.
Crawford & Doherty Foundry Co., Portland, Ore.
DeLaval Steam Turbine Co., Trenton, N. J.
Empire Pattern & Foundry Co., Tulsa, Okla.
Florence Pipe Foundry & Machine Co., Florence, N. J.
Fulton Foundry & Machines Co., Inc., Cleveland, Ohio
General Foundry & Mfg. Co., Flint, Mich.
Georgia Iron Works, Augusta, Ga.
Greenlee Foundry Co., Chicago, Ill.
The Hamilton Foundry & Machine Co., Hamilton, Ohio
Hardinge Company, Inc., New York, N. Y.
Hardinge Manufacturing Co., York, Pa.
Johnstone Foundries, Inc., Grove City, Pa.
Kanawha Manufacturing Co., Charleston, W. Va.
Koehring Co., Milwaukee, Wis.
Lincoln Foundry Corp., Los Angeles, Calif.
Palmyra Foundry Co., Inc., Palmyra, N. J.
The Henry Perkins Co., Bridgewater, Mass.
Pohlman Foundry Co., Inc., Buffalo, N. Y.
The Prescott Co., Menominee, Michigan
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Sonith Industries, Inc., Indianapolis, Ind.
Standard Foundry Co., Worcester, Mass.
The Stearns-Roger Mfg. Co., Denver, Colo.
Valley Iron Works, Inc., St. Paul, Minn.
Vulcan Foundry Co., Oakland, Calif.
Washington Iron Works, Seattle, Wash.
Dorr-Oliver-Long, Ltd., Orillia, Ontario
Hartley Foundry Div., London Concrete Machinery Co., Ltd., Brantford, Ontario
Otis Elevator Co., Ltd., Hamilton, Ontario

SEND FOR FREE BULLETIN

"Casting Soundness Can Be Controlled"

Write today to Meehanite Metal Corporation, Department 5E, 714 North Avenue, New Rochelle, New York.

MEEHANITE®



The tiny steel balls shown in the race ways of the Meehanite grinding plate are precision-made by the WINSTED BEARING COMPANY, Winsted, Connecticut.

Miniature steel balls are ground perfectly round on grinding plates cast in Meehanite metal

The fine grain structure and uniform solidity of Meehanite grinding plates enable the Winsted Bearing Company of Winsted, Connecticut to make miniature steel balls to the exacting requirements of the precision industries.

These exceptionally dense grinding plates, cast in quality controlled type "GA" Meehanite metal, provide long service life, maintain dimensional accuracy and can be heat treated without fear of distortion. In addition, Meehanite plates have high tensile strength (over 50,000 psi), high modulus of elasticity, low co-efficient of thermal expansion, excellent wear resistance and good machinability.

The tiny steel balls shown are used in miniature bearings, ball point pens and other precision instruments. They are made with the highest degree of uniformity and dependability. Each ball must be spherical within three to four millionths of an inch, can vary in size no more than five millionths of an inch and the surface finish must be better than half a micro-inch.

Meehanite grinding plates have been used by the Winsted Bearing Company for over six years with very satisfactory results.

If you would like more detailed information about the physical properties of Meehanite casting, write today for Bulletin AR-130 "Casting Soundness Can Be Controlled."

Over 20,000 steel balls ground perfectly round on Meehanite grinding plates are held in the teaspoon. The hermetically sealed glass jars contain over 50,000 balls.

MEEHANITE BRIDGES THE GAP BETWEEN CAST IRON AND STEEL®

MEEHANITE METAL

MEEHANITE METAL CORPORATION, NEW ROCHELLE, NEW YORK

Abrasive Cutting | *the best way to cut many materials the only way to cut some*

Allison Cut-Off Wheels

Wide variety of shapes and materials cut with abrasive wheels

• Speed and quality of cut make abrasive cutting ideal for a wide range of operations. For example: one inch diameter cold rolled steel can be cut with a wheel cost of under ½ cent per cut and in 3 seconds.

ALLISON Cut-Off Wheels can provide smooth, high-quality cutting for almost any type of material however hard. These include steels of practically all analyses including corrosion-resisting types, brass, bronze, Monel Metal and other non-ferrous: aluminum alloy, magnesium and many others.

Whatever the problem there is an Allison Wheel to meet it . . .

Profitable abrasive cutting means using the right abrasive wheel . . . and the proper abrasive cut-off machine . . . for the specific job. If the required result is a smooth, fine finish, without hardening or metallurgical changes, a WET cut is called for. Rubber bonded ALLISON Wheels give long wheel life and high quality cuts for such an operation. If the cut is a big one (over 2" solid) an OSCILLATING Cut-Off machine . . . with the proper ALLISON Wheel . . . will do the job fast and economically. Where quality requirements are less exacting, dry cutting with ALLISON resinoid bonded wheels is often the best method.

Allison
ABRASIVE CUTTING WHEELS

Consult a specialist for best results

• ALLISON specializes in the manufacture of abrasive cut-off wheels. Be sure that you are getting the most from your cutting methods. Abrasive wheel cutting is faster than sawing—in some cases it is 10 to 20 times as fast. The savings in cost can be tremendous. Why not let an ALLISON abrasive cutting specialist check your hardest cutting job?

ACCO

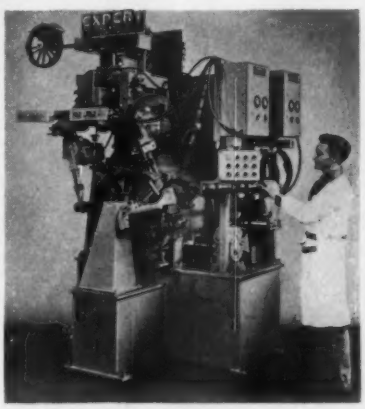
Send for Booklet "ABRASIVE CUTTING" Today

ALLISON DIVISION
AMERICAN CHAIN & CABLE
254-A Island Brook Avenue, Bridgeport 8, Conn.

metically sealed relays, and standardized enclosures with swing-out frames.

Line is reported the first to combine advantages of electronic control with the benefits of hermetically sealed relays. Basic unit size is 4 in. wide by 8½ in. high by 8 in. deep. All units have the same height and depth, but vary in width from 4 to 12 in.

General Electric Co, Schenectady 5, NY



AUTOMATED ARC WELDER, 8-station trunnion-type, features cam index mechanism and cam clamping mechanism for welding two automotive motor mount parts together at rate of 433 parts per hr. Machine welds by CO_2 shielded arc method; is adaptable to other methods. Unit is 8 ft high, occupies floor space of 4 x 5 ft. Cam drive powered by 1½-hp motor; welding current supplied by two 600-amp rectifiers—*Expert Welding Machine Co, Div of Expert Die & Tool Co, Inc, 17144 Mt Elliott Ave, Detroit 12, Mich*

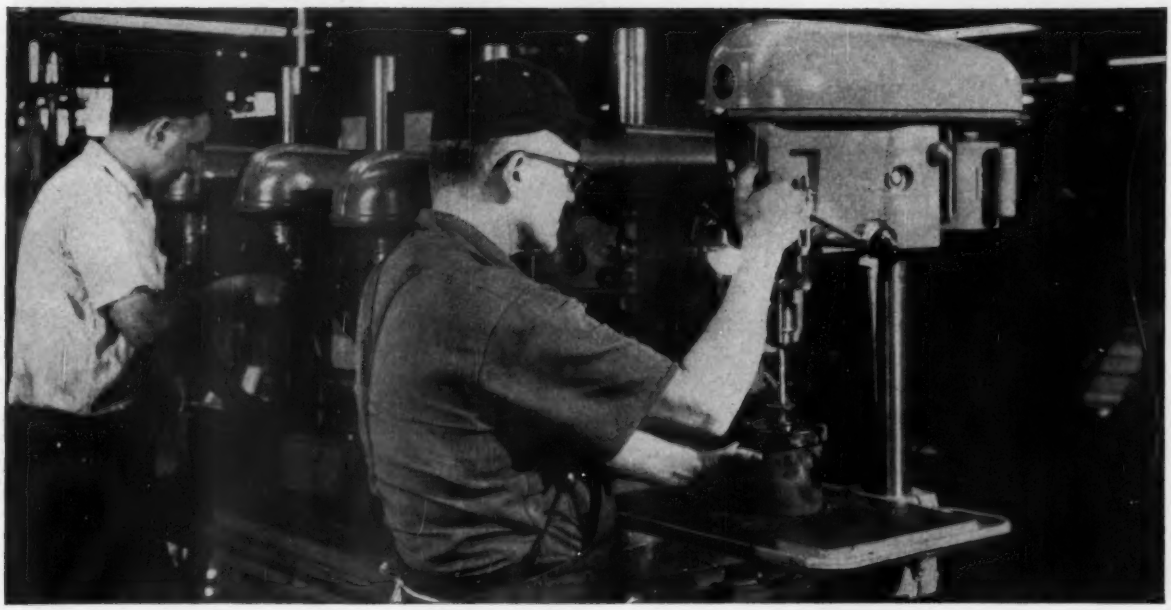
P & W Stub Tap Features Reduced Torque, Better Chip Disposal

Designed for screw machine use, this shorter length tool has a necked shank for generous lubrication; spiral point to reduce torque and improve chip disposal; and short thread length to prevent bellmouth threaded holes due to misalignment.

Available in high speed steel

ROCKWELL-BUILT

NEW DELTA 15" drill press



...replaces expensive special tooling

The new Delta 15" combines the ruggedness, power and precision of much heavier machines with unmatched power tool versatility. Here's how it can save you money on a wide range of jobs:

DOES MORE WORK MORE ACCURATELY—*Only* Delta offers a selection of *six* spindle adaptors for all production drilling operations—eliminates the need for costly single-purpose machines on many jobs. And each adaptor is mounted on a ground taper for *complete* accuracy, features a threaded collar for *positive* locking.

BIG MACHINE RUGGEDNESS—Delta's unmatched power tool know-how gives you extra rugged design and construction—massive one-piece head, big 2" dia. quill, oversized heavy duty ball bearings—that adds up to years of dependable, low cost operation even under heaviest everyday work loads.

EASY, CONVENIENT OPERATION—*Exclusive "universal" hand feed* combines the best features of pilot wheel and single lever feeds for adjustable leverage, freedom from striking table or fixtures, almost infinite choice of feed lever positions.

Counterbalanced belt guard completely encloses belt and pulleys, swings up for fast, safe speed changes. You get these and many more time and work-saving advantages found in no other 15" drill press!

SEE THE ENTIRE DELTA DRILL PRESS LINE—Get all the facts about the new Delta 15" and other new and improved Delta Drill Presses. Compare—then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Div., Rockwell Manufacturing Co.
618B N. Lexington Ave., Pittsburgh 8, Pa.

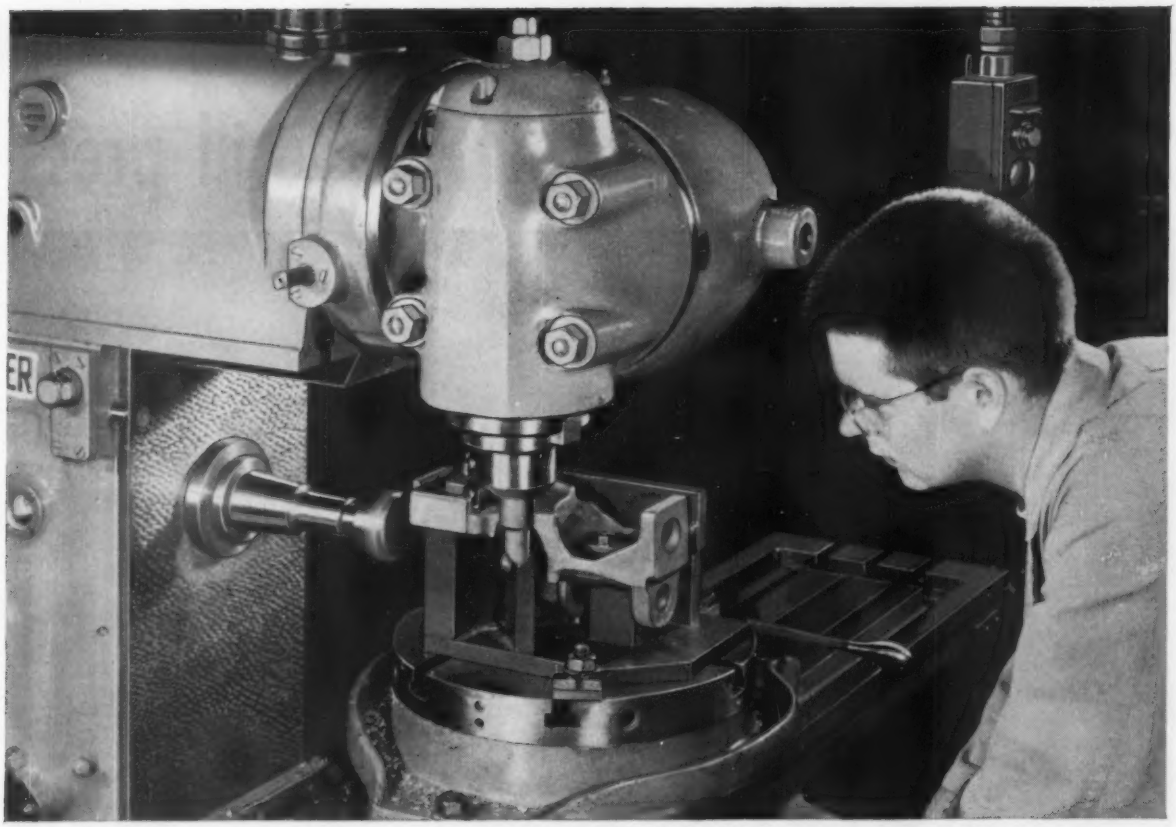
- ☐ Please send catalog on entire Delta Drill Press line.
- ☐ Please send booklet: Delta Power Tools Teamed with Machine Tools.
- ☐ Please send names of my nearest Delta Dealers.

Name_____ Title_____

Company_____

Address_____

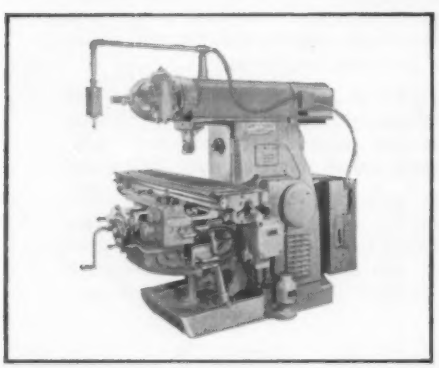
City_____ County_____ State_____



Horizontal Milling . . . Four-bladed face mill performs four horizontal milling operations on magnesium casting. Simple fixture on rotary table holds workpiece. Four milling positions accomplished through indexing of rotary table.

Vertical Milling . . . using a carbide two-lip end mill in the ram head spindle, three vertical milling operations are completed without disturbing the setup. Rotary table is used for indexing the workpiece.

Multiple setups and excessive handling eliminated



10hp No. 3 Model CH, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.

Kearney & Trecker Ram Head Milling Machine completes seven operations without removing workpiece

Kearney & Trecker's new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

The Ram Head machines are available with a choice of three heads—Universal, Vertical and Quill types which can be rotated through 360°. You can perform vertical, horizontal and angular milling on one machine *in a single setup.* They are built in No's. 2, 3, and 4 sizes in both plain and universal styles. Plain machines may be optionally equipped with Mono-Lever and Automatic Cycle Table Control.

For the full story, contact your nearest Kearney & Trecker representative, or write Kearney & Trecker Corp., 6786 W. National Ave., Milwaukee 14, Wis.

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Rotary-Action Paint Gun "Throws" Paint at High Speeds

Built on principle of a centrifugal pump, Rogers Rotary Magic Painter is powered by a self-contained motor that spins the rotor blades at speeds up to 22,000 rpm. Unit can be used with any water base or oil paint. It is manufactured by Martin Stove and Range Co., and is used for room painting, stencilling, and even for applying a fine oil spray to finished machine parts.

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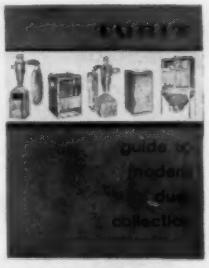

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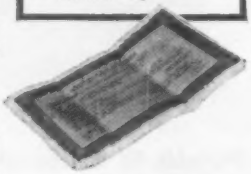

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air system. After power is turned on, standard is adjusted to desired leak rate value and the leak detector probe is inserted into gun fitting of the standard. Output indicator then shows appropriate reading. Unit weighs 13 lb.

General Electric Co, Schenectady 5,

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Accuracy of the image on the screen is said to be great; distortion over the full field is guaranteed to be less than ½ mil.

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Imported by Opto-Metric Tools, Inc, 137 Varick St, New York, NY

Circular calculator, the "Fraction of an Inch Adding Machine," permits continuous adding or subtracting of fractions, decimal equivalents, or mixed fractions and decimal equivalents. Device has only one moving part, is made from satin-finished aluminum. Price ranges from $2.75 in lots of 25 to $2 in lots of 1000.

Sheridan Advertising Specialties, 26032 Grand River, Detroit 19, Mich

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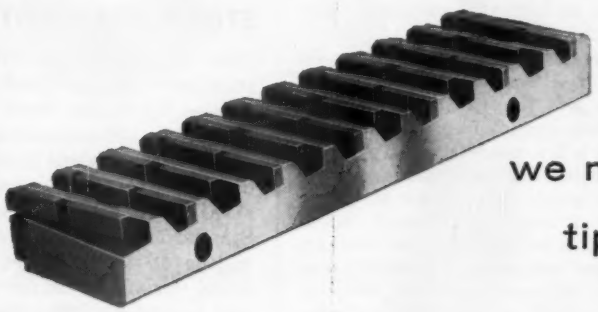

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News Item: *Statistics show that hospital emergency wards do a rushing business on weekends — and not just after Saturday midnite, either, but* all *weekend long — patching split heads, wrenched backs, mashed thumbs, broken arms and chopped feet. All this "business" results from that modern phenomena, "do it yourself."*

Any fool knows that "do it yourself" is the way to "Save - Save - Save," as the TV commercials say. But some of the *smarter* people have discovered that "do it yourself" isn't necessarily the bargain-counter proposition it's been made out to be — that the fun you get out of it (if any) generally costs *money* in the long run. These people are relearning a truth established years ago that the Division of Labor, or specialization, results in greater efficiency. This holds just as true in the production of industrial goods such as gears: the actual cost, hidden as well as apparent, of gears produced in a back shop or part-time department is bound to be greater than the ultimate cost of gears produced by an efficient, highly-specialized gear manufacturer like Cincinnati Gear. And combine the economic advantages that result from our efficient production and consistent top quality with the *ease-of-mind* that results from our traditionally top-notch *service*, and you'll understand why so many firms (firms who recognize "do it yourself" for what it is) depend on us year after year for all their custom gear requirements.

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ROUND TABLE Discussion

NIGHT TIME'S FOR SLEEPING

Should the same shop rules be in force on the night shift as on the day shift? Can any more leniency be allowed, or should equal discipline be enforced for both?

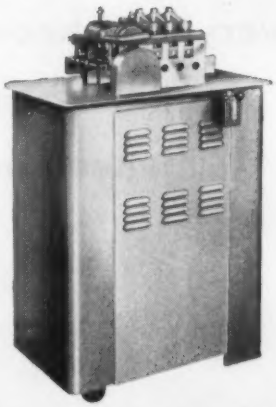
NIGHT-SHIFT work has always been a tremendous target for everyone. Always the talk indicates that they are the ones who make all the errors. They always are the black sheep who can be blamed for everything that goes wrong. Unfortunately for the day workers this is not always true. Most shops have qualified workers on the night trick and oftentimes they are tops. Yet because two or three-shift operations are very difficult to co-ordinate, we always end up with passing the buck.

Now the question of sleeping on the job is one which occasionally creeps into the picture. This is not too often encountered but one thing which a few workers do try to get away with. For them there is always a nice quiet, dark corner to take a snooze in when the boss is out of sight. It is forbidden, and all workers who get caught at it generally end up on the outside of the company buildings. It is not right for what one does others should have a right to do; either everyone has naps or no one. Production is what employees are hired for, not to sleep on the job.

A foreman on the night shift must study his men and he must see that all of them are on the job on the

"Miss Young, you remind me a lot of my wife, go get your time!"

FLEXIBILITY in Stock Straightening



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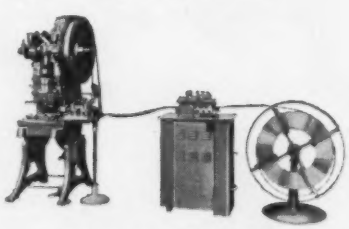
STOCK STRAIGHTENERS

Used in conjunction with a reel stand and automatic feed for punch presses, the Wittek Stock Straightener is a self-contained, motor-driven unit designed for maximum efficiency in the continuous straightening of coiled stock. Standard models handle stock with widths up to 12 inches. An infinitely variable speed drive permits any desired straightening speed so that the proper slack is maintained in the straightened strip between the unit and the press feed.



This typical Wittek automatic production feeding setup includes—Wittek roll feed mounted on the punch press, Wittek stock straightener, and Wittek self-centering reel stand.

Write for full particulars

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HY-PRO specialized tap engineering tells you

which tap where

for lowest cost per hole

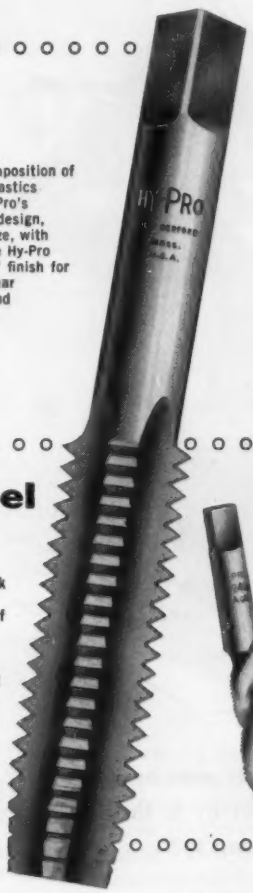
New alloys, new plastics, new tooling set-ups, and mounting production demands pose new problems daily in tap selection and use. HY-PRO tap engineering service provides prompt answers . . . the *right* answers that mean steady savings in tap expense, in time loss on the line, in reduced parts spoilage.

in plastics

Abrasive composition of most hard plastics requires Hy-Pro's multi-fluted design, .0025 oversize, with the exclusive Hy-Pro "Hardernell" finish for maximum wear resistance and free-cutting.

in die castings

Relative softness of alloys used causes tendency to close in and bind the tap. Hy-Pro's 2 flute spiral point oversize design meets these conditions, — provides free-tapping, clean threads.



in stainless steel

Hy-Pro spiral point design provides high-hook angle for most efficient cutting of this metal, and maximum tap strength. Ferrox surface treatment counteracts chip welding.

in aluminum

Hy-Pro's spiral (1) flute tap lifts chips out, gives best results in blind holes. Hy-Pro's spiral point design (2) is recommended for through holes. Chrome plate or nitride surface treatment resists abrasive effect of most aluminum alloys.

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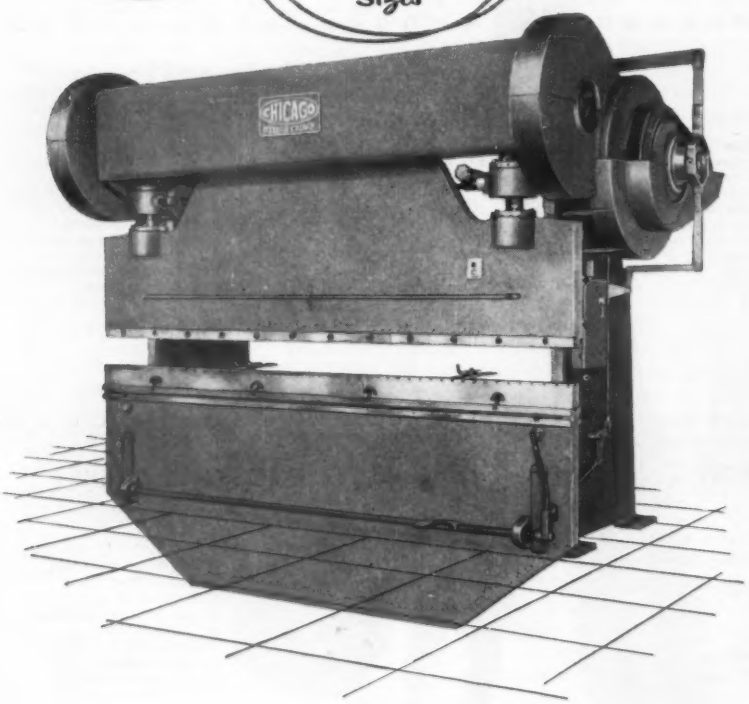

This is one of the Series D CHICAGO press brakes. It has a bending capacity of 10 feet by ¼ inch—150 tons. Over-all bending length is 12'-2".

Complete recommendations for any job on request.

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hours they are supposed to be. In this case the night foreman should have also been taken over the coals for he is the one under whom the condition was being tolerated.

It is very doubtful that this lathe operator had just started the practice of resting on long cuts. He had initiated, no doubt, a practice which all the men in the shop were following. Thus actually while the operator was the guilty person, management supervision also was in the wrong.

If the general manager singled out this one person for a lay-off without properly chastising the foreman or night superintendent, then company morale will certainly be at a low for a while.

Let us remember that people do what other people do. We, or many of us at least, copy style trends, actions and behavior of others, at least to some degree. We generally pattern our ways after those who are superiors or leaders. Workers will follow the leadership of the foreman. If the leadership is lacking, then the worker's ways become lax also and what supervision permits, the working force in general does.

Concerning this problem of sleeping on the job, no doubt the night foreman may also do a little disappearing act, maybe to the extent of even taking a snooze himself now and again. Certainly his control of his workers is notably lax. It is not that sleeping on the job is the bad feature, but rather the fact that the work in the lathe and the lathe itself are costly. The investment to the company is great. It hires people to run equipment and to take care of this

"Why can't you put a little ticket on the side of the box, like the other inspectors?"

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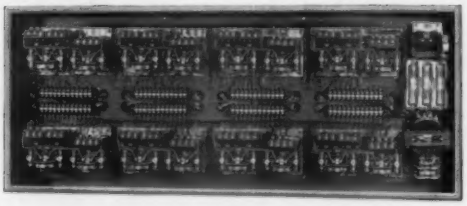
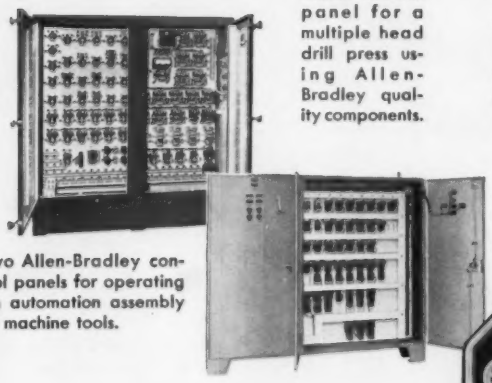


Motor control panel for a multiple head drill press using Allen-Bradley quality components.



Two Allen-Bradley control panels for operating an automation assembly of machine tools.

When the control panel furnished with your production machine carries the Allen-Bradley trademark of QUALITY, your customer's approval is assured! That is why so many leading machinery builders have standardized on Allen-Bradley controls. The "simple design" of all Allen-Bradley controls is your guarantee of trouble and maintenance free service.

No matter how complex your control requirements may be, as specialists in this field, Allen-Bradley's experience may be of valuable assistance to you. Call your nearest A-B office.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
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MOTOR CONTROL

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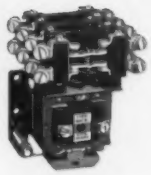
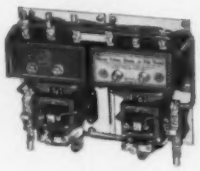
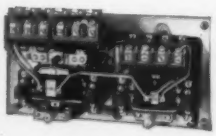


Bulletin 700
Universal Relay with
N.O.—N.C. Contacts



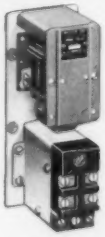
Bulletin 705 Size 2
Reversing Starter



Bulletin 715 Two
Speed Consequent
Pole Starter

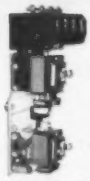
Bulletin 802T Adjustable
Lever Oiltight Limit
Switch

Bulletin 702 Three Pole
Size 2 Contactor



Bulletin 849 "On-Delay"
Pneumatic Timer

Bulletin 892
Handy Terminal
Blocks



Bulletin 704, Mechanically
Held, Hum-free Relay

Bulletin 200
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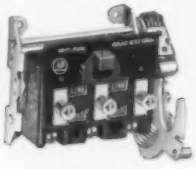
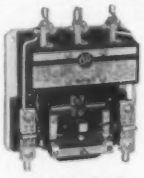
Bulletin 350
Reversing Drum Switch

Bulletin 836
Pressure Control in
NEMA Type 4 Enclosure

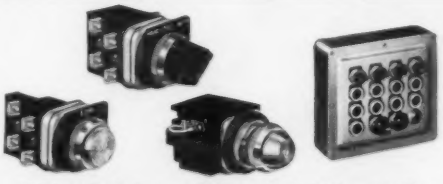


Bulletin 894
Visible Blade
Disconnect Switch



Bulletin 709
Size 4 Automatic
Starter

Bulletin 609
Three Phase
Manual Starter



Oiltight Push Button, Selector Switch, Press-to-Test
Pilot Light, and completely assembled Oiltight Station

Allen-Bradley *quality* components assure you millions of trouble free operations. The simple design, maintenance free, double break, silver alloy contacts, and rugged design features have made them the first choice among design engineers, contractors, and maintenance men. You just can't go wrong with this QUALITY line.

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Send for your copy of the new 7th edition of the Allen-Bradley Handy Catalog

3-57-MR

investment. It is in this way that the company can make a profit and by making a profit continue to employ its workers.

Little do workers realize, sometimes, that they are all part of the great team of operation in this country. Their take-home pay is based on what they can produce and while sleeping they can produce nothing. We are coming to the day when you can turn a machine on and it will do the entire job, but remember the lower grade of workers have forced some of this. Companies cannot stand for infraction of rules, no matter how minor these infractions may be. Foremen on the night shift, it is your job to see that your people work and do not sleep.

Charles D Townsend
West Hartford, Conn.

IRRESPECTIVE of whether a man is on the night shift or day shift, he should not be allowed to get away with a minor rule infraction. When a man violates a shop rule which prohibits resting on the job while his machine is taking a long cut, he deserves punishment, especially if the shop rule distinctly specifies that when a tool is in the cut the operator is supposed to be on his feet watching it to make sure nothing goes wrong.

One of the difficulties of disciplining employees for minor rule infractions is that many companies do not have hard-and-fast rules for such infractions. Foremen in these companies are at a disadvantage because there is no pat answer for disciplinary action in such cases. These minor rule infractions can include lateness, absences, failing to ring clock cards, refusal to perform a particular job, and unnecessary "resting" on the job. The foreman is frequently confronted with these problems. And if he does not take immediate action, he may be faced with an increasing run of such infractions.

What should be done when an employee violates a minor shop rule? Should the foreman overlook it, especially when he wants to get the work out? Should the foreman be easy or tough on the worker? Should the worker be disciplined if he gets caught cutting corners involving minor shop rules? There is undoubtedly one best answer to these questions. But that one answer is governed by the situation, the application of general personnel policies, the personality of both the foreman

(Continued on page 228)

One of the vital Perkins custom-cut gears which insure quiet, precision operation of UNIFIL® — the new automatic loom winder that replaces the hand-filled battery and consolidates all filling operations in the weaving area.

Perkins Custom-Cut Gears Specified for Universal Winding's New Unifil® Loom Winder

Quality and service determine Universal Winding Company's choice of Perkins custom-cut gears for many of their machines, including the new UNIFIL®. Perkins gears are precisely cut to exact specifications which eliminate noise, wear and backlash. This means fewer rejects, lower maintenance cost and longer gear life. Extensive facilities and modern equipment, backed by 52 years of gear-making know-how insure prompt delivery, as scheduled, to meet production needs. You, too, can benefit from Perkins *quality* and *service*. Perkins can cut your gears from any material — metallic or non-metallic. If you require a special deep or shallow pitch, a gear with a hub, clutch teeth or other special features, Perkins engineers will work with you to insure efficient and economical gear design. Ask us to quote on your next gear requirement.

YOURS ON REQUEST — Folder illustrating gears Perkins has made — face gears, generated and curvic clutches; bevel, spiral, helical and spur gears; ratchets, sprockets and ground thread worms . . . from all materials. Includes Perkins facilities for producing various gear types and sizes. *Write today.*

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A "useful life" is not

for production men

This Avey machine drills various patterns of holes in jet engine parts by changing program drums or by alternating two automatically-driven shot bolts which locate the table accurately from a radial position. Program drum also programs one or more of the four drilling units for drilling, reaming, and similar operations.

The machine consists entirely of standard Avey units: four Aveydraulic automatic units with 12″ feed; cast iron columns; 120″ fan type steel base; 60″ Electrodex table. Top column and unit have an in-and-out traverse of 20″. The ways are mounted on steel adaptor blocks which can be removed for different heights.

All units and the index table are push button-controlled.

If you're looking for flexibility in a special machine, your Avey man's the man to see.

for management

Many machine tool buyers were caught between the tax authorities' "useful life" of 20-25 years and their machines' profitable life of 6-7 years. If you were caught in this dilemma, you recovered only a fraction of a machine's cost through depreciation by the time it should have been replaced; so you couldn't build up any replacement reserve.

Now you have a collection of antiques which lose nearly as much money in production as they do when they're down. Furthermore, they lack the productive capacity to keep pace with your currently expanding markets.

Avey has a combination to get you out of this dilemma: first, a pay-as-you-produce plan which solves your ready cash problem; but more important, production machines with such a fast rate of return on your investment that you'll be making clear profit in two years or less.

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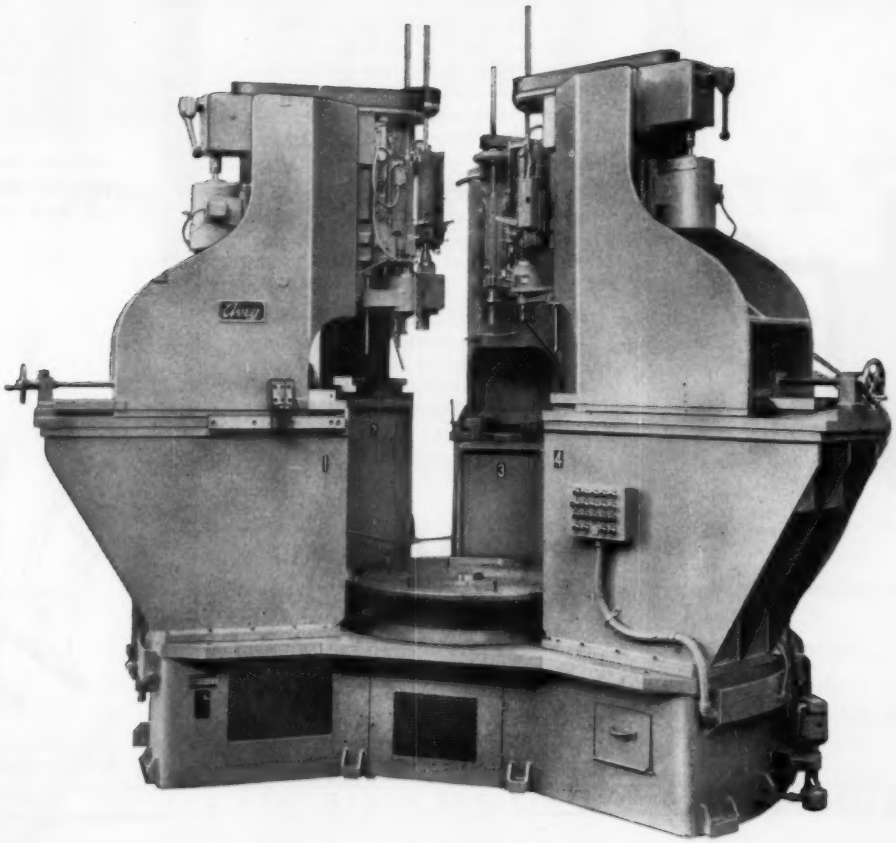
drilling, tapping, production machines

a happy one

Avey



INSTANT CONTROL FROM ANY ANGLE!

On operations where instant control is imperative install a mushroom-head pushbutton. Even a gloved hand can find it easily from any angle in every emergency. One fast push and you are in command.

Westinghouse mushroom heads are available in a wide range of colors and materials . . . the popular red plus seven other shades of homogeneous, longer wearing plastic. For more rugged applications there are the anodized aluminum buttons in plain, black and bright red.

In Westinghouse Oil-Tite* controls, both operators and enclosures are moistureproof. A tight rawhide seal around the stainless steel operating shaft prevents oil and other harmful liquids from reaching electrical connections. And drainage holes will not allow liquids to be trapped in the housing. Enclosure covers are tightly gasketed with mounting holes in separate wells. Oil simply cannot seep in.

These pushbuttons are tailored to your needs . . . at standard prices. All parts are interchangeable permitting minimum stocking of components.

Booklet B-7022 will tell you more about Oil-Tite controls, and the new 72-page pushbutton guide B-6749 will give you information on the complete line. Write to Westinghouse, Box 868, Pittsburgh 30, Pa. *Trade-Mark

J-30251

YOU CAN BE SURE... IF IT'S

Westinghouse

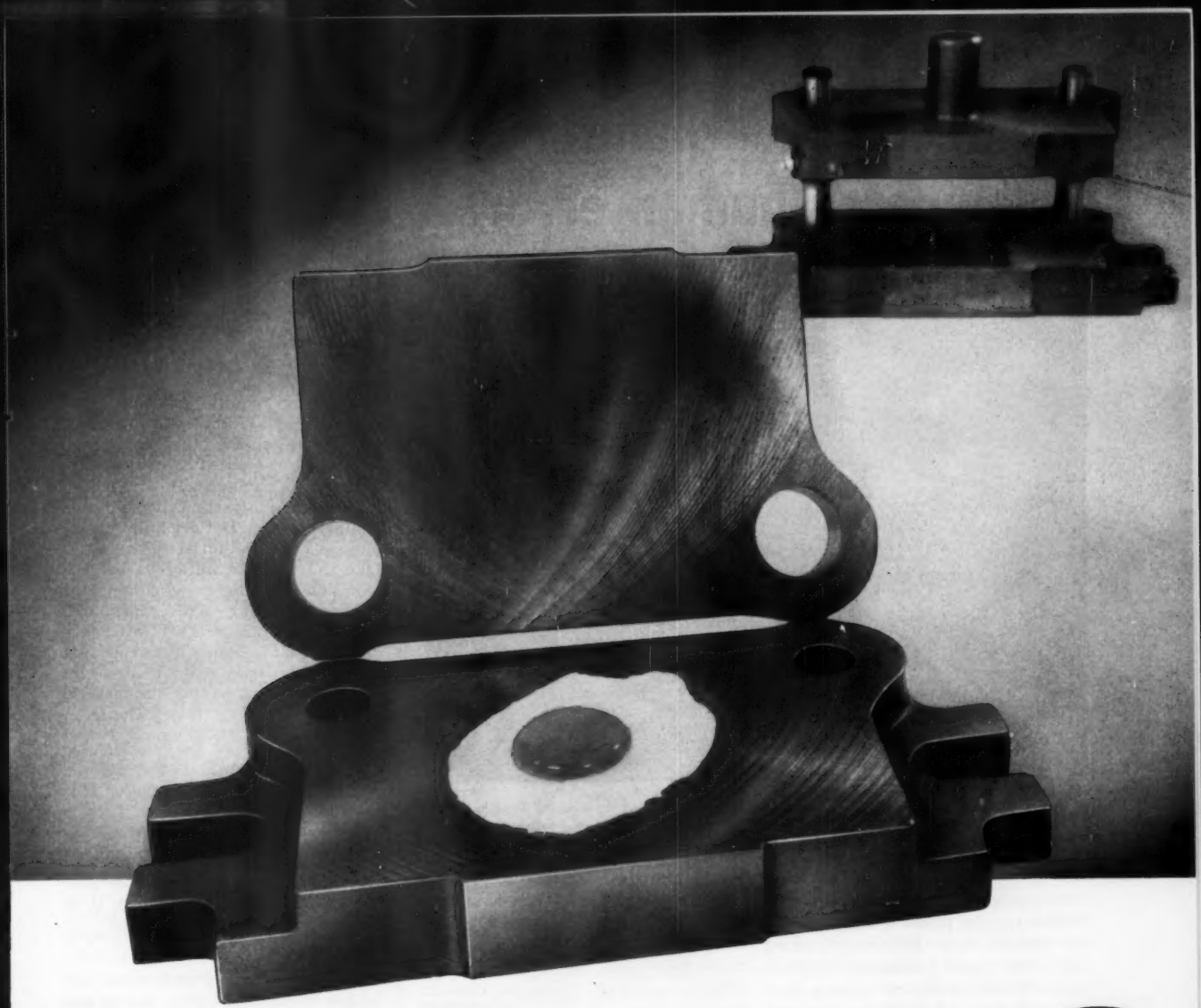
and the employee, and, finally, by proper timing.

But a foreman can get himself in a jam by inconsistency in enforcing these rules. Another pitfall, which is quite prevalent, is not too little discipline, but applying it too late. Letting one or two men get away with breaking minor shop rules can start a rash of such violations among the rest of the workers. In general, the easy treatment of these violations will fail to correct the situation. Establishing a precedent of overlooking minor shop rules is unfair to the company as well as the workers. It is not fair to allow employees to break rules, and then suddenly impose tough penalties without warning. It is therefore believed that the violation of any shop rules, no matter how minor, requires disciplinary action.

There are a number of basic steps which should be used in all such cases. The first step for an initial offense should take the form of an admonition. This is a gentle criticism accompanied by advice on how to avoid the same problem in the future. If the offense is again repeated, the employee should be given a warning. This is notice in advance of action which will be taken if undesirable behavior again occurs. This second step should be put in writing. Copies of the letter should be given by the foreman to the personnel department, and to the employee.

I know of one company that has a printed form which is used for this purpose. This form is called an "Employee Contact Report." It is used for disciplinary actions involving failure to comply with shop rules. Foremen using this written warning have found that the majority of

"He says it's academic with HIM! Cause he's a time and motion study analyst."



WHAT'S COOKING ON DIE SETS?

The egg you've laid, brother, if the job isn't right.

Whether you're the tool engineer or the diemaker, once the die's in the line it has to produce or you've had it. And today it has to produce hundreds of thousands, even millions, of parts to pay for itself.

Obviously the die set is no place to cut corners. It's not only the heart of the die but frequently it's the least expensive part of the die anyway. A few dollars saved here won't go very far spread out over the life of the die, and it can prove costly.

Making quality die sets is our business. Quality means precision and stamina:

Precision for fast, accurate diemaking and lasting production accuracy.

Stamina to assure long, trouble-free operation in the line.

For your convenience, Detroit Die Set stocks over 2000 standard die sets. Our new catalog covers them all, plus details on specials, too. Ask for your copy on your company letterhead today.

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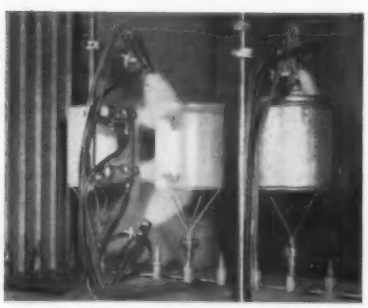
But it takes more than just ordinary spray equipment to do the flawless, cost-saving jobs that are demanded today. DeVilbiss meets this demand with experience and know-how that combine the full knowledge of materials, production methods, and spray techniques with the most versatile, efficient automatic spray equipment that's available.

Why not let us test run your product in our Customer Lab — without obligation — for a report of actual costs, plus projected savings over your present system? Our nearby representative will gladly make the arrangements.



Simultaneous painting of exterior and interior of these 5-gal. pails is typical of versatility, efficiency of DeVilbiss automatics.

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minor employee infractions have been corrected by the employee receiving the first written warning. If this fails, in that the offense is again repeated, the third step is a "Written Reprimand." This reprimand specifies that if the offense is again repeated, the employee will be given time off without pay, or discharged (whichever is felt advisable by the foreman). Recording these minor rule infractions makes all interested parties aware of a situation, and they can be used as evidence in cases which may require grievance-committee action. Verbal warnings and reprimands, on the other hand, may not even be accepted as evidence by a grievance committee.

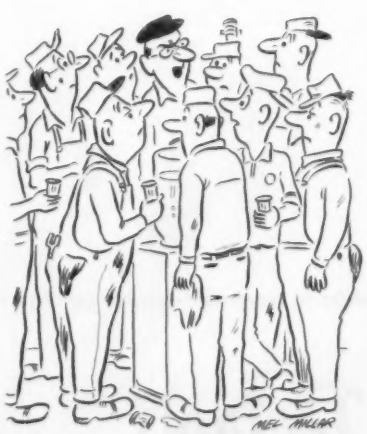
Minor rule infractions demand disciplinary action. But disciplining employees for violation of rules should take the form of initial verbal admonition and advice and subsequent written warning and reprimand. Then the errant worker will only have himself to blame if his repeated violation of shop rules brings him time off without pay or discharge.

Harry Kaufman
Philadelphia, Penna

TAIL-END CHARLIE

Is it fair to pass over a man for promotion because of frequent absenteeism and tardiness, particularly if he has seniority rights to the job?

ORDINARILY a man wouldn't last any longer than a snowball in hell on any job if he had the record Charlie Jones established at the Make-be-



"Maybe we'd better stop talking about the new foreman. I'm the new foreman."

lieve Manufacturing Company. The man must have terrific ability to turn out work in record time in order to overcome such a handicap in attendance and promptness. And now he is up for promotion with a question as to whether he is worthy of a better job!

Strange as it may seem, there was a lathe hand I knew who lost more time than any combination of men in the shop; he came dragging in at all hours of the day, yet he had such a charm with his machine that he excelled any other man in producing the goods. I don't know if the boss went on any occasional benders with the man, but no one ever heard a word of objection coming from the shop head over the playboy's laxity. I cannot see any reason why this chap would be considered for any responsible job that might be in the offing. His main weakness was liquor —maybe Charlie's was just that too, so where's the difference?

Our friend Al must be a sucker to give any consideration to Charlie's fitness even though the man is likely to have the backing of a grievance committee. I am of the opinion that our lax friend Charlie will find out that he's not such a big shot after all when the matter comes up for consideration. An organization created for the employees' best interests is not going to ignore the basic laws of fair play simply to promote the welfare of one of its members who defiantly ignores the foundation of what is right and wrong. What kind of a group leader would such a careless person amount to? Wouldn't he carry over on his new job the destructive practices that reduced his effectiveness on the old one?

How things arrived at this stage is a question any man of sound reasoning would ask. There must be a screw loose somewhere or the man would have been giving his walking papers long ago. It looks as though laxity wasn't monopolized by Charlie alone—why wasn't he apprised of his carelessness as a matter of course in the foreman's line of duty to maintain high working standards in the shop? Such things as habitual tardiness and slovenly attendance are not usually subject to rewards other than a well-rounded tin can tied to the seat of the guilty one's trousers.

Of the two evils I consider tardiness as being the greatest of Charlie's sins. With the scarcity of skilled help we have at the present time one cannot apply remedial screws too tightly, yet the long drawn out method of securing another job—with its form filling details and interviews

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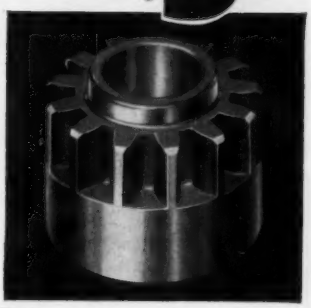

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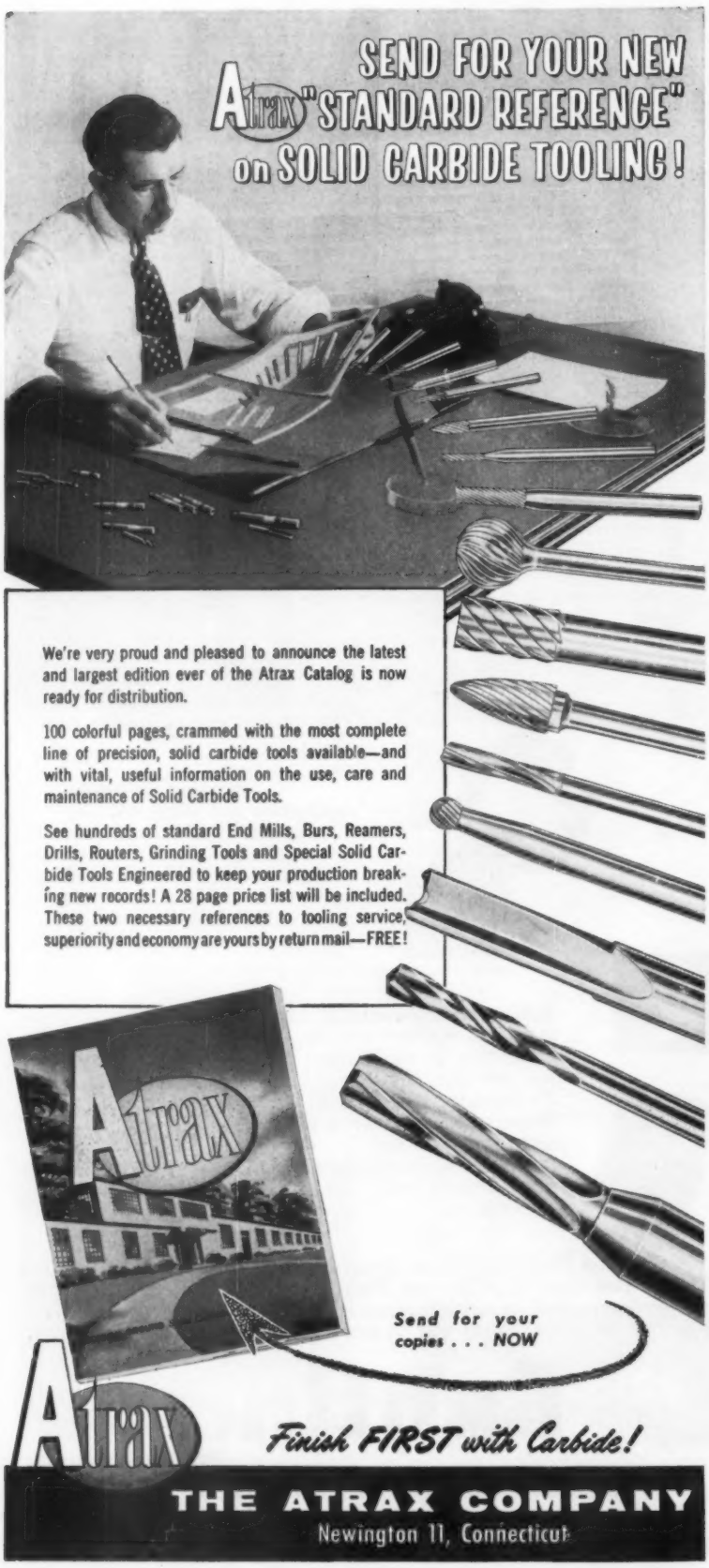
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with know-it-all know-nothings—in a way sort of balance any fears of disciplinary reprisals. Tardiness is often a habit which if nipped in the bud can be eliminated, or at least kept down to the absolute minimum.

For those who still have time clocks in operation I would suggest one of the most effective means to combat the evil. It works like this: Immediately following the deadline, lock up the clock, as had been done in one case of my observation. This outfit—and it was a good place to work—required that you, as a tardee, go to the department clerk who would fill out a form and make a record of your entrance time. Then you, feeling small, naturally, would go through the gauntlet of snickers before you reached your board or bench as the case may be. No doubt they have improved this system since I was employed there and require tardees to have the foreman, superintendent, and general manager countersign the slip before you finally arrived at the bench!

J Homewood
Laguna Beach, Calif

THE SELECTION of new group leaders is somewhat of a problem under any condition. Usually there is a small amount of ill feeling in regard to the choice. Generally speaking it makes little difference after a few days except to one or two would-be or perennial gripers.

In the case of two men who have all the qualifications except that one has a little more seniority, the problem becomes a little more acute. To-

"All right, wise guy, take that thing down!"

Crane acking ompany

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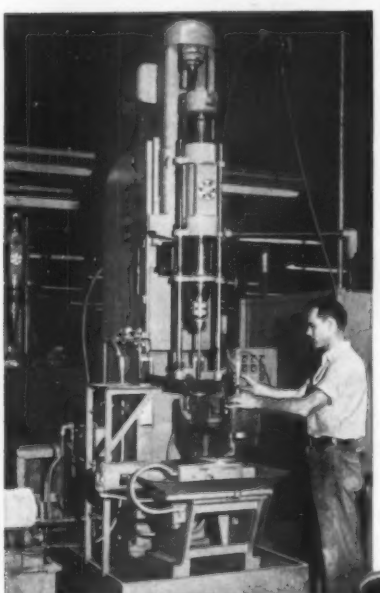
38 YEARS INDUSTRIAL PROGRESS

WHY Emerson Electric MICROHONES Laminated Steel Rotors

The Emerson Electric Manufacturing Company is constantly searching for the best possible processing methods. Working with Micromatic engineers on problems encountered in processing shaft holes in their laminated steel rotors, Emerson Electric found that Microhoning would provide much higher production quality while lowering processing costs. The following Microhoning benefits are now obtained:



Model 728 Hydrohoner with automatic Microsize, Microdial and two station rotary indexing fixture. Hole Tolerances: Diameter .0002 inch, straightness and roundness .0001 inch.

CUT REJECTS
With former processing method rejects ran too high. Microhoning controls size and assures a clean hole—rejects are substantially reduced.

ELIMINATED OPERATIONS
Old processing method required two operations. In one operation, Microhoning generates size and straightness within specified tolerances.

REDUCED BALANCING TIME 70%
To preclude vibration and poor operating characteristics, it is essential that shaft hole be concentric with O.D. of rotor. Microhoning reduced by 70% the amount of dynamic balancing correction required.

PROCESSING COSTS CUT 70%
Current figures show the cost of Microhoning shaft holes in rotors to be less than 30% of processing by old method.

Rotors (from 2¼ to 4 inches long) are all Microhoned on the same machine by changing adaptor in fixture and resetting stroke length.

Learn why Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

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☐ Please send Micromatic literature and case histories.

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MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

day, seniority is a big factor and too often companies are forced to go along with run-of-the-mill-type of men because they have been with the company for years. This not only actually handicaps the foreman but also causes the company to suffer in general. Usually it is not realized because there is no way to compare the value of good men with men of medium caliber under the same conditions. Yet from an analysis standpoint, the man who is more alert to conditions and can advantageously accomplish the job quicker and more easily will give to the company a lower operating cost than one who merely does his job for the paycheck. We have many workers of both types in our industrial world and every company has both to choose from. Oh yes, there are a few others who are not touched by this category, such as those who are a relative of some official and are living on their connections.

The attendance of a man certainly indicates the character of the individual. Perhaps he has a good reason, but usually it is just a human trait. As is indicated, he will be the first to cry about being accused and unjustly judged, that given the job he will reform and so on. All of this is empty words from anyone since no person whose life is one of being a "tail-end" will ever reform and become prompt.

So the foreman doing his job for the company must select the individual who will be of the most value to the company, a person who can at some later date be promoted higher in the organization. Group leadership is an important step, and if a company is going to really grow these men must be the best among the ranks. A group leader must set a good example for his men and certainly a man who is constantly late is not a good example.

Should we deny Charlie Jones the

"Curly, you old skinflint. Guess which one of your bright young employees answered the $64,000 question?"

promotion? Certainly, because while he has been with the company more years than Bob Handee, probably in actual hours Bob may have the edge anyway. Jones' seniority cannot carry him through life if he constantly persists in breaking the rules of the game, whether he has been warned or not. True, Al was lax in not filing a complaint, but what foreman wants to become petty?

So, regarding the question of seniority, if the man has all the qualifications for a promotion, then promote him, by all means, but if he has a serious fault that will not be a benefit to the company, then pick the best man for the job. Then stick by your decision, sell the idea to your superior and to your company.

Charles D Townsend
West Hartford, Conn

ALL THINGS being equal, the early bird should get the worm. In the case under discussion, the late bird has only himself to blame for losing out as a promotion choice because of his lateness and absenteeism record.

In my opinion, Al has no problem in his choice between tardy senior man Charlie Jones and punctual junior man Bob Handee for promotion to group leader. Although company policy may call for promotion by seniority, if ability and physical fitness are equal, I believe that "Tail-End Charlie" should be denied the promotion solely because of his poor attendance and on-time record.

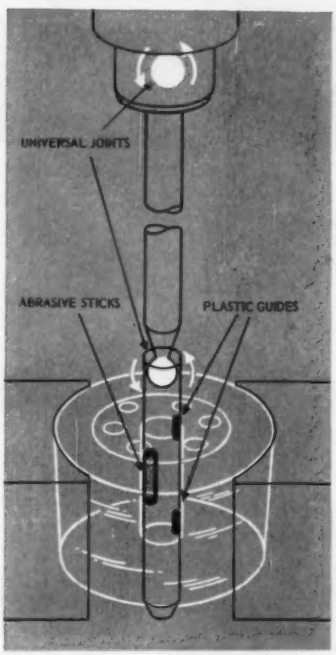
Charlie claims he was never told that his absence would stand in the way of a promotion, and that it was unfair to invoke his attendance record now in view of the fact that he did his work well. To these claims I would offer this observation: it is an established principle that management has the right to expect and require regular attendance on the job by the workers. While it is true that the foreman has in this instance been negligent is reprimanding the tardy worker and enforcing this right, the foreman's negligence does not bar him from applying the right in a case of promotion. To hold otherwise would, in effect, be condoning and approving absenteeism—a condition which would surely lead to even more grave problems. For this reason the foreman is justified in denying a promotion to a worker solely because of his poor attendance record.

As for the foreman's concern that

HOW MICROHONING Laminated Rotors Cuts Processing Costs

Emerson Electric squirrel-cage rotors are made of special "electrical grade" steel laminations and each lamination is coated with oxide insulation. In processing the rotor, the O.D. is turned concentric with the shaft hole. Then, in one operation, Microhoning accurately generates finished size and straightness of shaft hole without any change in hole location.

The Micromold tool has two universal joints in the drive shaft which allow the tool body to align itself with the shaft hole. Microhoning of holes is along same axis from which O.D. was turned.



For electrical and mechanical efficiency, assembled motors must have a uniform air-gap between rotor and stator of .006 inch to .011 inch. Because laminated surface is rough and close tolerances must be held, special guided Micromold tools are used. Plastic guides above and below abrasive sticks, control dressing of abrasive and assure generation of round, straight shaft holes.

Before installing Microhoning equipment, two operations were required to finish shaft hole—rejects ran high. Microhoning greatly reduced the amount of dynamic balancing correction required.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

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This drunken thread specification will undoubtedly make many gages now in use obsolete — but this bonus of quality from pace-setting design and manufacture assures PMCo gage users continued use and high accuracy.

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Greater Cleveland

the grievance committee might consider seniority a more important factor in promotion than attendance, I believe that the committee will fairly weigh the evidence and agree that "Tail-End Charlie" should be denied the promotion because his poor attendance indicates a lack of interest in the job. It would indeed be setting a poor example for the rest of the men to condone absenteeism by promoting tardy Charlie to group leader.

Harry Kaufman
Philadelphia, Penna

THE IDEA of Tail-end Charlie kicking about being passed over in the matter of promotion seems strange to readers in Britain today, where the utmost difficulty is experienced in persuading operators to accept advancement. So much good money is now being made at the tools, without the worry of heavy responsibility, that the rankers show no enthusiasm for taking it on.

To offset this trouble, some companies are introducing piecework under what is known as the fellowship system. This system dispenses largely with the need for shop foreman and charge hands—at least, that's the claim made for it. The idea is that all agree to weigh in and if any man is temporarily held up, he voluntarily turns to and lends a hand elsewhere. Properly worked, no man need ever be idle. The piecework money earned is pooled and divided equally between the members of each squad and the management is asked by the

"—And my wife tied this one on my finger to remind me not to give you a raise!"

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FERGUSON MACHINE CORPORATION

ROLLER GEAR DIVISION, DEPT. MI-2, P. O. BOX 5841, ST. LOUIS 21, MO.

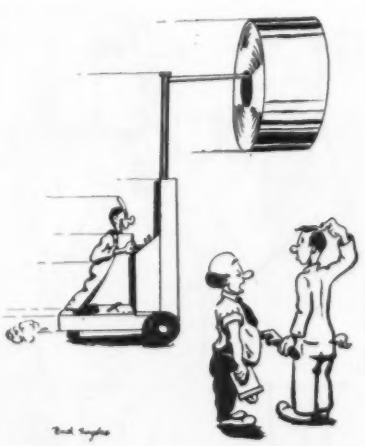
men to remove any drones in the hive. Thus, each man is in himself a foreman.

Al showed a fear of the grievance committee that was not justified. No man who could not or would not report on time should be considered for promotion. That goes also for the individual who likes a day or two off now and then. Such an appointment could do nothing but harm to production flow and shop discipline since the tail-ender would be in no position to remonstrate with bad timekeepers because of his own shortcomings.

There could, of course, be circumstances in which poor attendance at work, even habitually, might not indicate lack of interest in the job. Poor health, domestic commitments, other interests, to cite a few, but any man so hamstrung is certainly not a subject for promotion, and could not reasonably expect even a grievance committee to champion his cause in that respect.

Bad timekeeping and frequent absence from work is evidence of lack of interest and of laziness, besetting sins which rule out promotion prospects for the victim. Al's plea that Charlie Jones was never warned of the possible consequences of his sins fairly puts the cat among the pigeons. Al is no foreman, but has in him the makings of an excellent wet nurse.

A fairly wide knowledge of the problem convinces me that quite 90% of bad timekeeping and frequent absence from work is reprehensible and could easily be avoided, given a real interest in the job and a sense of punctuality and responsibility. It



"O.K. So what happens when he stops suddenly?"

is noteworthy that in all works, habitual loss of time is confined to an irresponsible or lazy few, and wise management takes the earliest opportunity to promote such to the outer side of the factory gate. They are a permanent headache to their foreman, a menace to good factory discipline, and a blot on the industrial horizon.

Al does not seem to give much consideration to Bob Handee, the deserving, the interested employee, the good timekeeper. With the exceptions of seniority and bad timekeeping, Handee seems to have everything that Tail-end Charlie has, and yet, Al says grudgingly "I guess I'll promote Handee," and with regard to Tail-end Charlie, "It's pretty severe—denying a man a promotion only because of attendance . . ." (as if punctually and regular attendance were not important). Ed overlooks the fact that seniority is not always a virtue and bad timekeeping is a vice, usually in more senses than one. It often happens that both are negative qualities.

Furthermore, Ed seems to have no fear of Handee casting himself on the mercy of the grievance committee if *he* is passed over. Can it be he feels Handee would regard that as beneath him? If so, let's hand it to Handee and to Jerico with the laggard Charlie. Every sane management promotes merit and merit only. Why should Ed be so tender about passing over the unreliable Charlie, why so apologetic? Who else would break a lance in such an unworthy cause? Could folly go further than to condone laziness and grudgingly recognize merit? It's a mockery of all that good management stands for, it's a mug's game.

C Donald
Lanarkshire, Scotland

IT DOESN'T appear exactly right for Al to be compelled to promote a worker to a higher position simply because of fear of what a grievance committee may think or decide.

You know what the bee said when he crashed into the windshield of a speeding car — "Ouch! This takes guts." So, Al, that's just what it is going to take on your part when you face this question squarely. If you are put on a spot because of an individual who has become slovenly in his habits of attendance, it is necessary that you take the stand that

(Continued on page 242)

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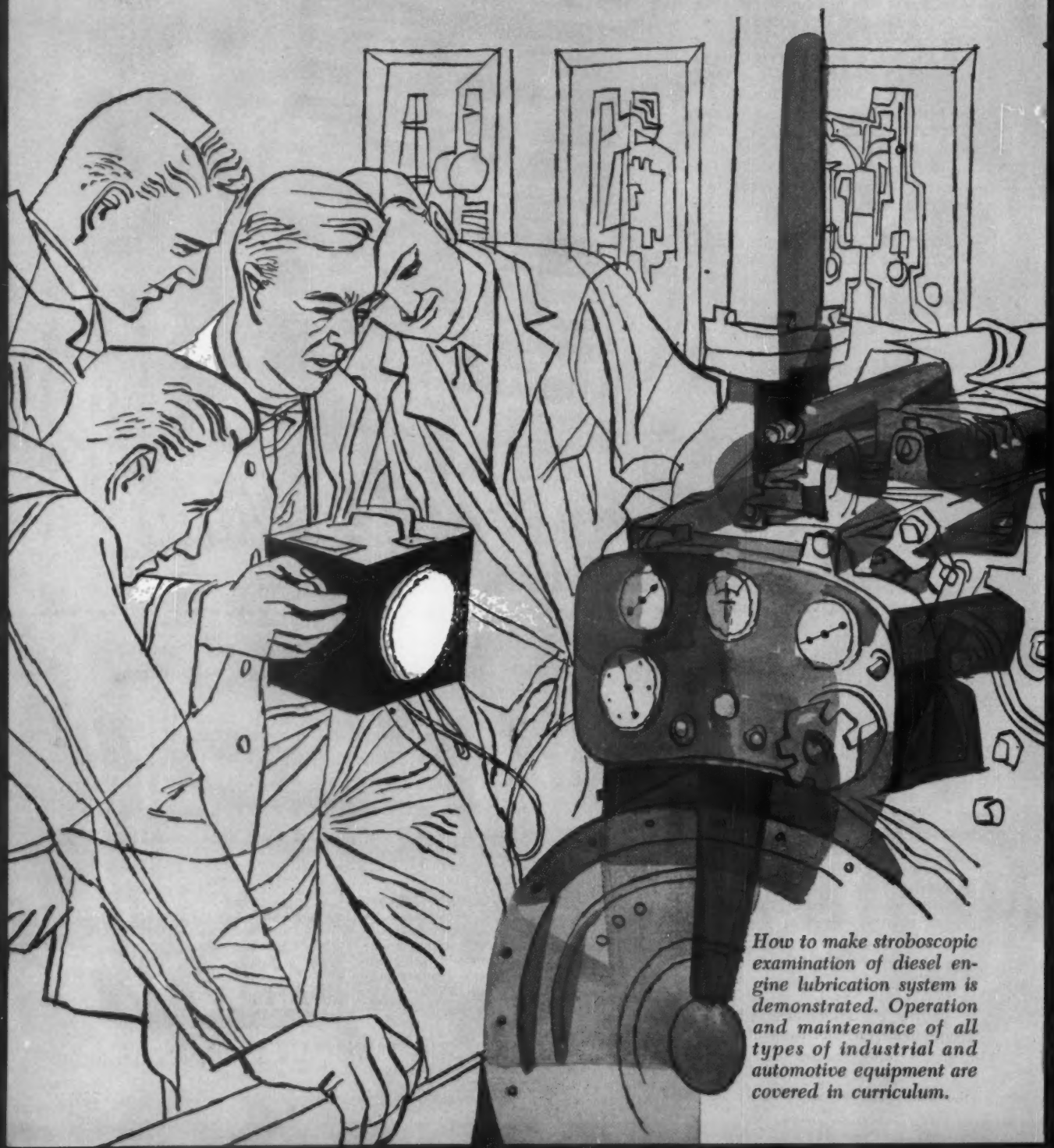
prepare men for
industrial technical service work?

Here's how Standard Oil



How to make stroboscopic examination of diesel engine lubrication system is demonstrated. Operation and maintenance of all types of industrial and automotive equipment are covered in curriculum.

Lectures, shop and lab work comprise training course.

trains its men

At the Standard Oil training center on Chicago's south side—not far from the Company's refinery and research laboratory at Whiting, Indiana—men who have demonstrated an aptitude for such work are given a 17 week course in industrial lubrication, equipment maintenance and metal working. And thus begins the training Standard Oil gives its men who are to provide technical service to customers.

Most men selected for this Sales Engineering School have college degrees in some engineering or scientific field. And in most cases these men, prior to attending the school, have had field experience in technical service work to start them off with an appreciation of the problems industry meets in lubricating equipment and working with metal.

This course for lubrication specialists and engineers includes lectures and work in chemical laboratory, engine laboratory and machine shop. Senior Standard Oil men, recognized authorities on lubrication and metal working, are the instructors. Other Standard Oilers with teaching skills and years of field experience, direct the shop work and supervise the school's laboratories.

Class, shop and lab work are augmented by field trips to plants where "students" learn first-hand more about the lubrication problems confronting industrial customers.

The Standard Oil Sales Engineering School has graduated 15 of these classes. The many men who have completed the course are now serving customers out of Standard's 23 offices in fifteen Midwest and Rocky Mountain states. Would you like one of these men to call on you? Then telephone your nearby Standard Oil office. Or write Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

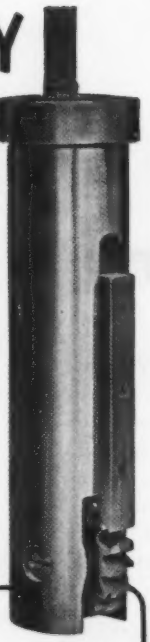
STANDARD

STANDARD OIL COMPANY
(Indiana)

Testing and comparing bearing lubrication methods.

Kinematic viscosimeter is used to test viscosity of lube oil. C. S. Brown (right) learns to run test. Brown, like many classmates, has science degree.

The INSIDE STORY about NATIONAL Keyseating Millers



NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

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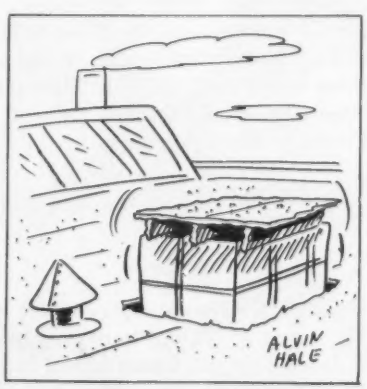
will pave the way to a better understanding of such questions in the future. You might as well have it out now with the committee so as to prevent a repetition at some later date.

The purpose of the grievance committee is to assure justice to an individual who might be caught in the jaws of discrimination. It is up to you, Al, as a department head, to determine what constitutes justice for the employer. It doesn't seem that an employee who has no appreciation for regular attendance and promptness, should justly complain because he is being by-passed for another of regular habits even though his service with the company is not as lengthy as his own.

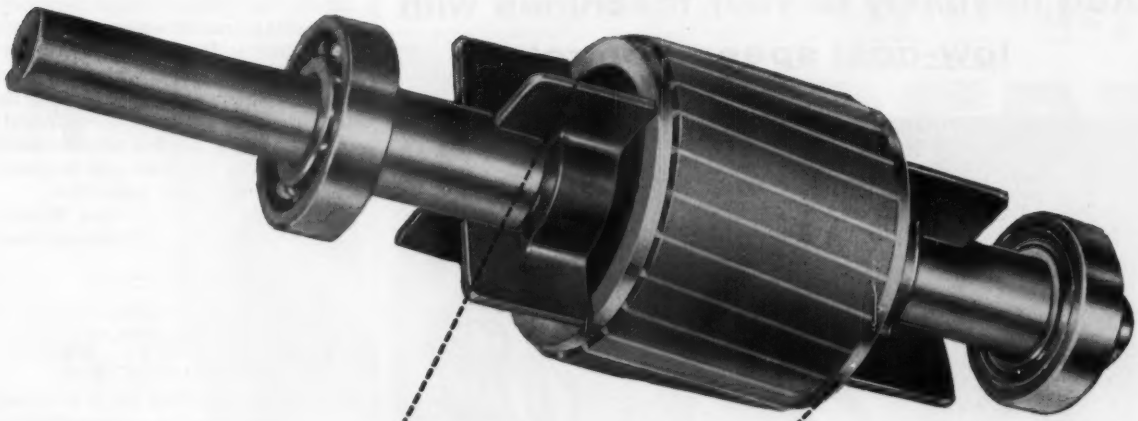
It is remotely possible that a job entailing greater responsibilities may be an incentive to an individual to make him realize the importance of regular habits. Should Al take such a chance he would also be gambling on the possible expense created by the man's absence in the event that he should continue his old practice of tardiness and unnecessary absence. Should Al weaken and promote the erring employee, would not the other workers be led to believe that a man can get ahead whether or not he has the interest of the plant at heart? By depriving the man who failed to realize his opportunity Al would be setting a good example to the others.

While the term seniority implies length of service in time only, there certainly should be some recognition of quality of service affecting its cumulative value. How else could one interpret lack of attendance than indicative of lack of interest in one's work unless, of course, extenuating circumstances decree otherwise. Tardiness is, and always has been, considered a definite lack of will power.

When a man whines because he



"Put one more up there, he says. O.K. I'll put one more."



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You want this Rotor design...

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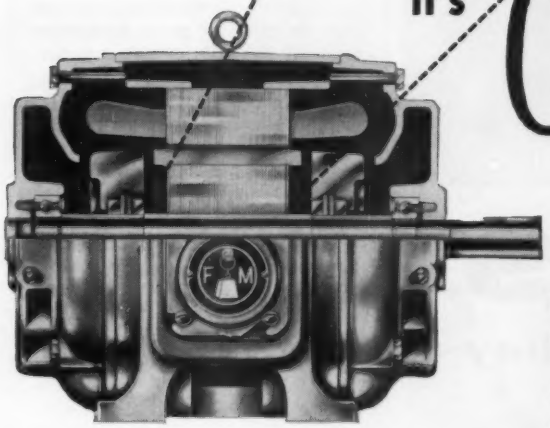

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Columbus, Indiana

hasn't been warned about tardiness and taking time off whenever he took the notion, it denotes poor sportmanship. If this is an actual case, then there must have been a slip-up on the foreman's part in not reprimanding the fellow for his practice—not that it gives the man any loophole to lay claim for the promotion.

Rex Warren
Waterloo, Iowa

QUICK STUDY . . . OR TRY-AND-SUCCEED?

Is a foreman the best judge in sizing up and placing a job applicant in his own department? Or is Personnel better equipped to gage the abilities and experience of the worker?

THE HIRING of a new employee has become quite an event in the lives of everyone in a company. It has been felt that for years the foreman was doing too much work and he needed help. So the personnel department was established. Then, in order to keep busy, it became a public relations department and as it grew from short pants to longies it assumed the role of being judge of everything it surveys.

Now it is true that our foremen are often overworked and actually the screening of employees can really ease his burden, but when it comes to finally choosing the man the foreman is the last word. Judgment by the foreman or, in fact, anyone else, is purely comparative. We place one idea against another. Our concept can be entirely false and would-be employees sometimes foul up the entire system. Many times the man who

"I can't understand what it is the stupid jerks that work in this place dislike about me."

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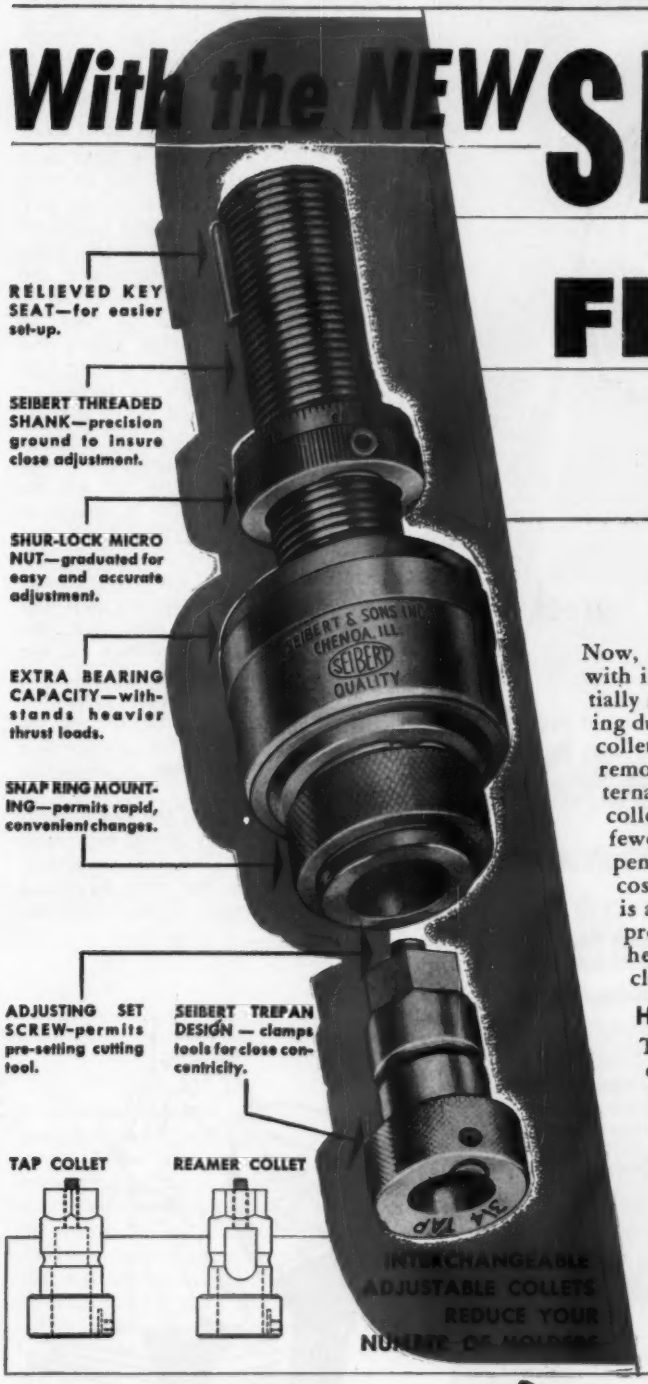
With the NEW SEIBERT FLOATING HOLDER


RELIEVED KEY SEAT—for easier set-up.
SEIBERT THREADED SHANK—precision ground to insure close adjustment.
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Fast Change Pre-Setting Collets Reduce Number of Holders Needed

Now, with the new Seibert Floating Holder equipped with interchangeable auxiliary collets, you can substantially reduce costs on tapping and reaming jobs requiring duplicate pre-set tooling. As illustrated, the auxiliary collet is snap-ring mounted in holder for quick and easy removal. No wrenches or drifts are required. An internal adjusting set screw permits pre-setting tools in collet without removing holders. Thus you require fewer holders per job, and because collets are inexpensive you effect substantial savings in overall tool costs. Close concentricity is maintained because tool is accurately held in collet by trepan clamp which is precision machined to close limits. Elimination of hex nut clamping principle also provides extra clearance when tapping in counter bored holes.

Heavy Duty Holder Assures Long Service Life

The holders are heavy duty roller-type and are especially designed with extra bearing capacity to assure long service life. All shank types are available in a range of sizes including the adjustable adaptor shank illustrated. Send for full information today on these new cost cutting tools.

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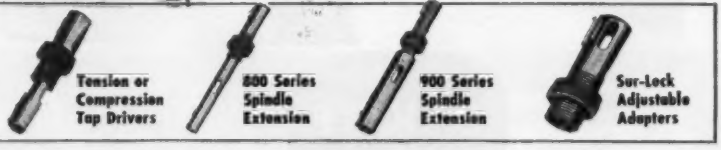
Get the complete story on the new Seibert Floating Holder. Ask for illustrated specification sheet or have a Seibert Sales Engineer call at your plant to check over your tooling requirements.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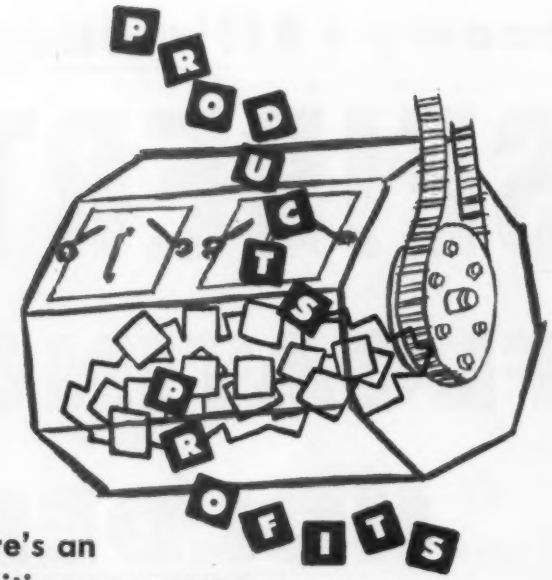

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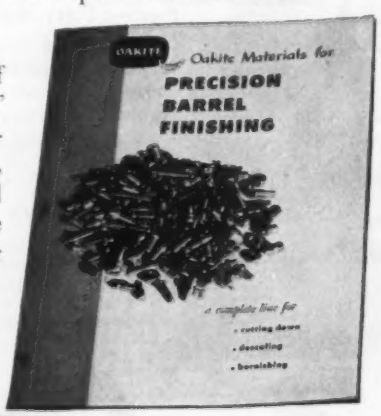

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really has something on the ball is not the one who openly shouts his own praises, or, if he does, not in such a manner as to draw attention to himself and indicate his worth to the company.

Personnel departments are filled with people holding jobs. Most know only a little about people. They have questions to ask and if the answers don't match the predetermined pattern, then "We don't need you now" is the answer. At least in the olden days a prospective employee did have a chance to talk personally to the man who would be boss. In those days two people talked the same language and the worker had a pretty fair chance of indicating that he could or could not do the job.

Personnel screening has become big business. It employs people who love to dabble in tests and act important. Our criticism is meant to be constructive. There *is* work that employment offices can do to advantage to save the supervisor's time. The obtaining of necessary data and application forms, arranging the facts in a clear-cut manner for the interview with the department head for example. But when the personnel department finds time to set up training programs for prospective employees something is radically wrong.

We must say that the mistakes in judgment will be made regardless of who chooses the new employee. Not all factors can ever be found out except under actual conditions

"I was wondering if I might get an increase in salary so I could raise enough money to take an aptitude test and get a better job so I can quit here!"

of work. We want to caution foremen that just because a man talks big doesn't prove that he has the complete know-how. Perhaps he does but many times he's bluffing. If we are to choose all employees by tests and charts there are going to be a lot of misfits running around. In fact, probably the personnel department would prove to have as many as any other department.

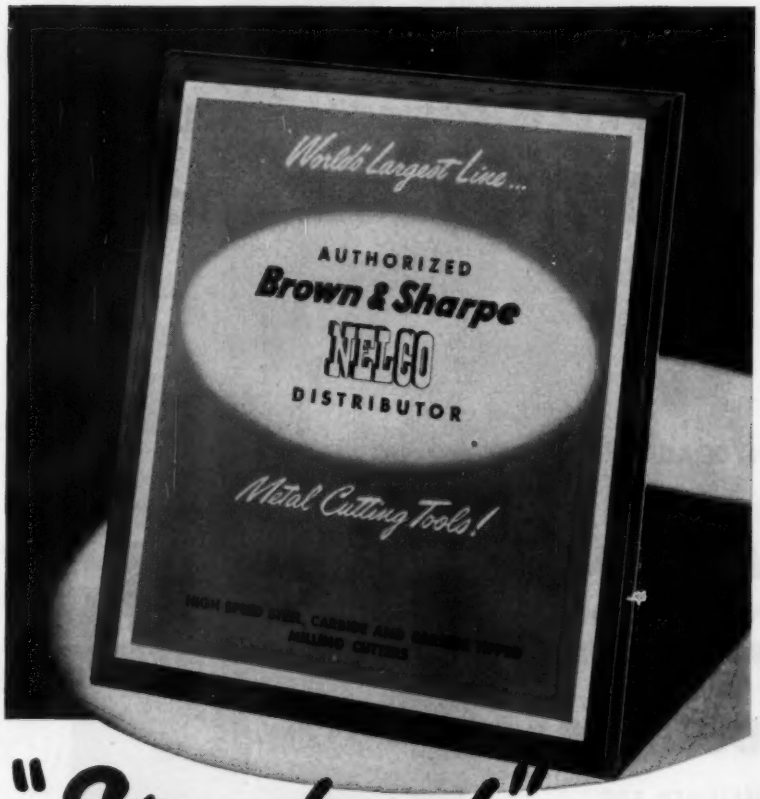
Seriously, the choice of a new man is not an easy task and it should not be taken lightly by either foremen or management. Nor is the employment of a new man going to cause the company to go out of business if the wrong choice is made. Past experience, and the ability to get along in your company should be the biggest factors in weighing the man. What he was or how things worked out in another company should be considered only comparatively. Conditions alter cases and you were not among those present to evaluate at the time. Why fully condemn a man for conditions that might have been well beyond his control?

Regarding Ed's problem, the money spent for vocational guidance in this case could be put to better use in training men for leadership and bringing them along to become future company managers. Let's remember nobody is right all the time in employing workers. Use those methods that best suit the conditions and don't be one of the pioneers in selecting workers by the guinea pig method—tests only.

Charles D Townsend
West Hartford, Conn

IT IS PRETTY hard to say whether a good foreman's opinion is to be preferred over that of a method of evaluating by way of scientifically controlled courses put on specifically for that purpose. A foreman, be he good or a topnotcher, is an individual who may have a one-track mind, may be prejudiced toward certain things.

The good foreman sheds petty troubles like a duck does water and usually wades in throughout the long day to accomplish his purpose. It is obvious that he is on the lookout for the best men he can get for his department. Now what about the men upon whom he has to depend for getting out the work? If all applicants for work in the plant were robots, we might be able to make a fair comparison. Fortunately all



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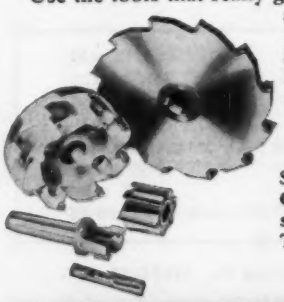
You can rely on him to save you days and dollars with superior tools, superior service!
Use the tools that really give you a COMPLETE selection . . . a speedy solution to all your cutter problems—over 3000 "standards" are as near as your phone. Switch to the most complete source! See the Brown & Sharpe-NELCO Distributor in your area . . . today!



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DESIGNED FOR . . . profitable mass production, The Engelberg Model BG8A-FT9 accurately grinds large surfaces or gangs of parts in a fixture with extreme rapidity.

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FAST MACHINING is assured by high speed wet or dry abrasive belts, backed by a ground steel platen. Controls are pre-set for feed and pressure. Quick approach of ball-bearing table is followed by hydraulically controlled in-feed down to Micro-Stop limit. Eliminates waste . . . cuts cost. New design incorporates larger pump and coolant capacity with easier access for clean-out. Redesigned one piece frame plus wrap-around splash guard.

SPECIFICATIONS

Automatic Table Surface	13" x 28"
Capacity	9" x 11½", 15½" or 17½"
Abrasive Belts	8" or 9" x 107"
Drive Units	5 or 7½ HP
Belt Speeds	(5 HP) 4100 SFPM standard; 2550, 3550, 4600 optional (7½ HP) 5000 SFPM standard; 2500, 3500, 5500 optional
Coolant Capacity	85 gallons
Overall Dimensions	Height 72½"; width 44"; depth 48"

THE ENGELBERG HULLER CO., INC. 192 Seneca St. SYRACUSE, N.Y.

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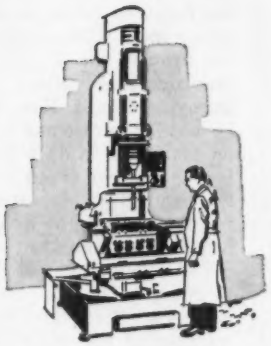
workers are individual in nature and this lends spice to the troubled foreman's daily routine. Some have this thing called conscience while others do their damndest to get away with murder.

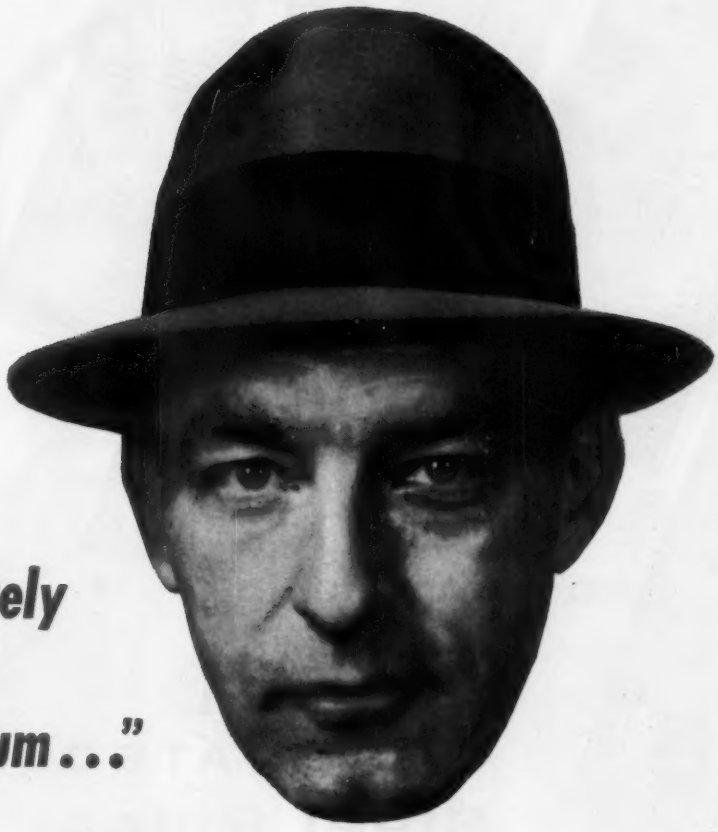
Toolmakers, as a class, register a pretty high score in the "supersonic" calculating machine and because of the interesting nature of their work cooperate effectively to a pretty high degree in keeping busy. Toolmakers share one thing in common: they have the skill and experience to produce work effectively. Their experiences may be varied but the foundation of the trade is built upon the work they have already come in contact with. There are as many varieties of so-called toolmakers as there are blondes on a crowded beach. Their myriad kaleidoscopic shades of differences make it hard to place them in proper categories. It is for this reason that some foremen get cockeyed when trying to decipher the individual he is interviewing.

To eliminate this possibility some of the more progressive firms have taken it upon themselves to resort to scientific means to ascertain the potentials of an unknown who makes application for work. It is only natural to believe that a certain amount of training would enable the employer to weigh specific qualifications and handicaps in proper placement of individuals before thrusting them on the over-burdened shoulders of the foreman in whose department he is to be assigned.

Let us assume that in a small shop employing up to a dozen toolmakers the question arises as to the most effective means of determining the quality of an applicant of whom

"Of all the low-down, stinkin'-rotten dirty tricks to play on our boss . . . why didn't I think of it?"





"TRUKUT® completely eliminated gum and scum..."

A large manufacturer of mold bases had a problem with grinding coolants. The grinding oil mist was causing a heavy gummy scum to form on the machines and floors.

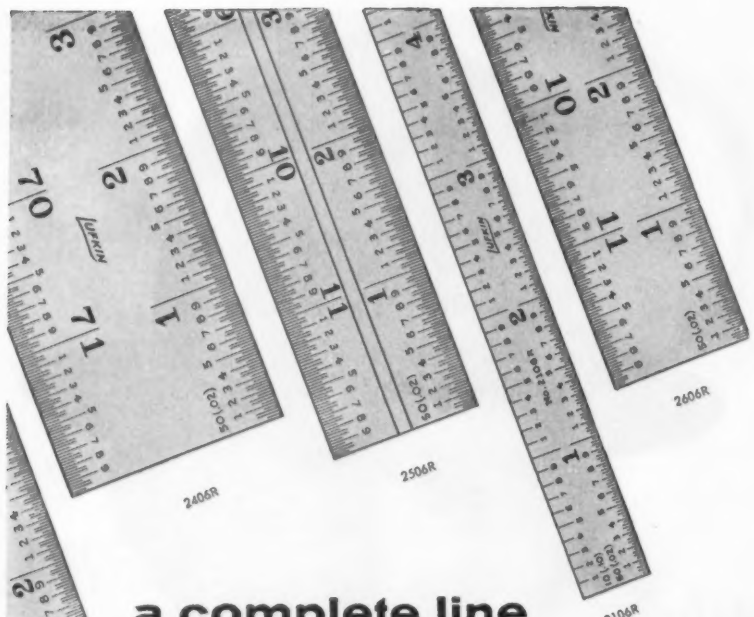
Sinclair Representative J. H. Schindler was called in to help solve the problem. Mr. Schindler reports: "I knew from actual experience that Sinclair TRUKUT EP Soluble Oil, Grade C, would give good wheel life and fine finishes without gum or scum. I submitted a 5-gallon sample for test. After changing to Sinclair's grinding coolant, the gum and scum were completely eliminated.

"Within a month, this plant swung over to TRUKUT in all grinders, as well as milling machines."

If *you* have a problem with grinding or cutting coolants, it will pay you to look into the advantages of Sinclair TRUKUT EP Soluble Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS and COOLANTS



a complete line of DECIMAL GRADUATED Steel Rules BY LUFKIN

You'll find exactly the decimal graduated rule you want in the complete line of Lufkin machine divided steel rules. Many models from narrow pattern to heavy spring tempered, including shrink rules and combination square blades. Lengths to 72 inches. Graduated 10ths and 50ths in accordance with latest "American Standards". Available plain or with Chrome Clad finish that wears longer, resists rust and stains and is easier to read.

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consult your industrial distributor

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406

nothing is known. It seems on the surface that the foreman in this case should be the sole judge of an applicant's fitness to fill the bill. Undoubtedly a central organization working in close cooperation with the foreman could be effective and would meet with no opposition from the head of the department and, at the same time, relieve him of a few annoying details. Here is a situation in which the foreman has some time on his hands to do a little checking before the man is put on the payroll. No centralized department created for the purpose of looking into the fitness of an applicant can excel the practical judgment of the man who is going to be the director of the worker's efforts once he becomes a member of the organization.

No foreman wants a man in his department who will not be acceptable to the rest of the working crew. Unfortunately this is something which will take time to determine and usually it reveals itself in situations as they arise on the job. Plant psychologists may be wizards at their business of analyzing a person's makeup, and most foremen are pretty shrewd in detecting a man's weak points, but there is a limit to their mastery.

It seems pretty hard to get away from the idea of a foreman being the sole judge of a man's fitness, but advances in machinery and methods have come upon us with staggering speed to make us change our ideas of what is best for all concerned. It is obvious that a foreman has his limited capacities and it resolves itself into the size of the shop being the determining factor as to whether he should be called upon to assume the roll of chief interviewer or let the matter of appraising be assigned to a separate department.

Harrison Mitchell
Topeka, Kans

"So . . . you think better with your feet on the desk. . . . But what's the snoring for. . . ?"

New Books

FBI REGISTER OF BRITISH MANUFACTURERS—1957 (29TH EDITION). *Published by Kelly's Directories Ltd, and Iliffe & Sons Ltd, Dorset House, Stamford St, London S E 1, England. 1124 pages, 7½ x 9½. Price $6.00.*

A comprehensive and accurate guide to a substantial cross-section of British industry, this well-known publication lists the products and services of over 7000 member firms under more than 5400 alphabetical headings. Other sections of this book give names and addresses of companies, information on trade associations, and a glossary in French, German, and Spanish giving the translation of every product term used in the main body of the guide.

A STUDY OF FACTORS AFFECTING THE UNIFORM ELONGATION OF TITANIUM AND TITANIUM ALLOYS—*By F C Holden, H R Ogden, and R I Jaffe, Battelle Memorial Institute. Published by Office of Technical Services, US Dept of Commerce, Washington 25, DC. 40 pages. Price $1.00. Order as PB 121213.*

Limits of uniform elongation were measured for typical alpha, alpha-beta, and beta titanium alloys. Specimens were studied in three microstructural conditions over a temperature range from –75 C to 300 C. The report contains graphs supplementing the text, complete tabular data, and representative flow curves.

THE COLD EXTRUSION OF TITANIUM—*By A M Sabroff and P D Frost, Battelle Memorial Institute. Published by Office of Technical Services, US Dept of Commerce, Washington 25, DC. 50 pages. Price $1.25. Order as PB 121267.*

The methods of cold shaping of other metals were successfully applied to unalloyed titanium during preliminary experiments. With an initial approach based on cold extrusion of steel, studies were conducted on two grades of unalloyed titanium to evaluate effects of die design and extrusion reduction. For-

"OUR CJ TOOLING is fast and clean for heavy duty work on sheets, and we're also getting big profit from punching holes in channels, angles etc. That's a tough proposition for the average shop . . . but not for us! With our WALES equipment we cut vees and corner notches at the same time. It really boosts our production."
WALES CJ Units punch unlimited straight line staggered and scattered patterns . . . round or shaped holes. Die retention design features rapid die change WITHOUT REMOVING UNIT from set-up . . . provides controlled slug ejection. Time saving and money saving. Same units may be used over and over again in other patterns.

SEND FOR BULLETIN No. 10A
Shows actual job work and complete data of CJ sizes.

WALES MOBILE FIELD UNITS
Demonstrate CJ and other tooling right at your door. Ask for details.

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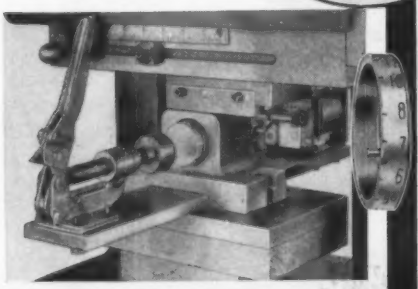
"...the Wales-Way is the PLUS-PROFIT way"
AKRON, NEW YORK
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

MARK *Your* PRODUCT FOR *More Sales!*

for identity, for product recognition

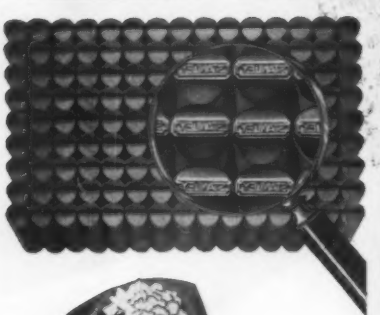
BY HAND...

handstamp trade marks, legends on short run components.



BY MACHINE...

automation in marking on production runs, manually, hydraulically or by air.



BY PRESS...

for metal, wood or plastic products with standard or special marking dies.

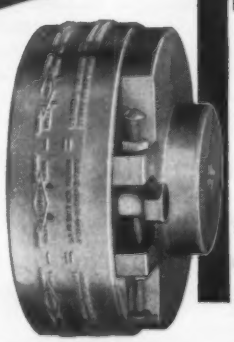
BY HOT STAMPING...

for indenting softer materials or stamping gold leaf or foil into plastic, leather, etc.

BY PRINTING...

on virtually any surface with flat, concave, convex or roll printing dies.

Send for folders and descriptive literature on Parker marking tools and machinery.



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ward extrusions with reductions of 40, 50 and 60% were accomplished on 3-in. billets with diameters of 1½ in. A fluorine coating combined with oil-graphite-molybdenum disulfide lubricant prevented seizing between work and die and produced a good surface finish. Working pressures were comparable to those required for steel, and extruded bars showed uniform deformation and work hardening.

REPORT OF NRL PROGRESS. *Published monthly by Naval Research Laboratory. Available from Office of Technical Services, US Dept of Commerce, Washington 25, DC. Annual subscription rate $10.00 domestic, $13.00 foreign.*

These reports have been available for some time on an individual issue purchase basis at a price of $1.25 per copy. They may now be obtained on an annual subscription basis. Each issue contains articles concerning non-classified research and development and discusses shortcomings discovered and advancements made in materials and methods, and ideas for new technological developments. The content usually concerns research, electronics, mathematics, mechanics, metallurgy, ceramics, plastics, optics, nuclear and atomic physics, solid-state physics, astronomy, and astrophysics.

INVESTIGATION OF MODIFIED 12% CHROMIUM STEELS, INTERMEDIATE TEMPERATURE APPLICATIONS—*By P Shahinian and J R Lane, Naval Research Laboratory. Published by Office of Technical Services, Dept of Commerce, Washington 25, DC. Order as PB 121226. 26 pages. Price 75¢. Also available on microcard from Photoduplication Service, Library of Congress, Washington 25, DC. Price $1.80.*

Development by the Navy of a useful 12% chromium steel modification without columbium is described. The report describes creep-rupture properties of the 12% grade modified by additions of molybdenum, vanadium, columbium, titanium, and carbon. Tests were conducted at 1100 F and

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to Bring Down Milling Costs!

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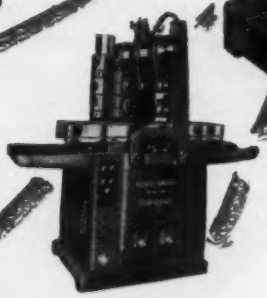
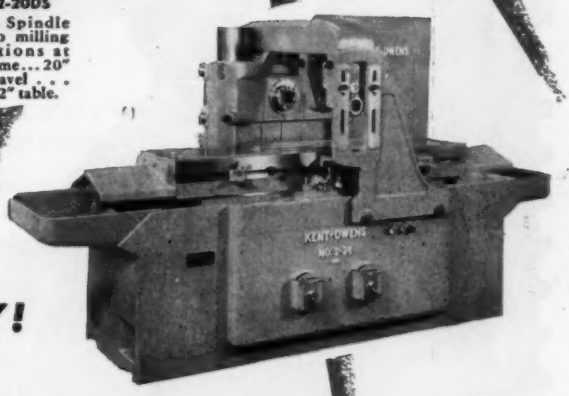
No. 2-20
20" table travel... 42" x 12" table.. fully automatic hydraulic table feed.



No. 2-20DS
Double Spindle for two milling operations at same time... 20" table travel ... 42" x 12" table.

No. 1-14DS
Double Spindle for two milling operations at same time ... 14" table travel ... 32" x 9" table.

No. 2-20V
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. ... 42" x 12" table.



No. 3-36 ... 36" table travel ... 64" x 16" table ... full automatic hydraulic feed.

STEP UP SPEED and ACCURACY!

Put the work on Kent-Owens Machines for top-speed milling and topmost accuracy to keep your costs at a minimum! Advanced features throughout these rugged machines make the difference ... greater dependability ... accuracy maintained in meeting tough production schedules. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to spindle. Write for bulletin #754 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, O.

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Measures Height to 61"
Accuracy ± .000005" per inch of length

Completely eliminates the old fashioned time consuming, cost boosting method of wringing gage blocks together and assembling with fixtures and accessories to complete a "stack" of the desired height.
Simple, easy to use, fast. Any good workman can make fantastically accurate measurements with speed and ease.

The new Micro Accurate Height Gage is another WEBBER exclusive. There's nothing like it in all the world.

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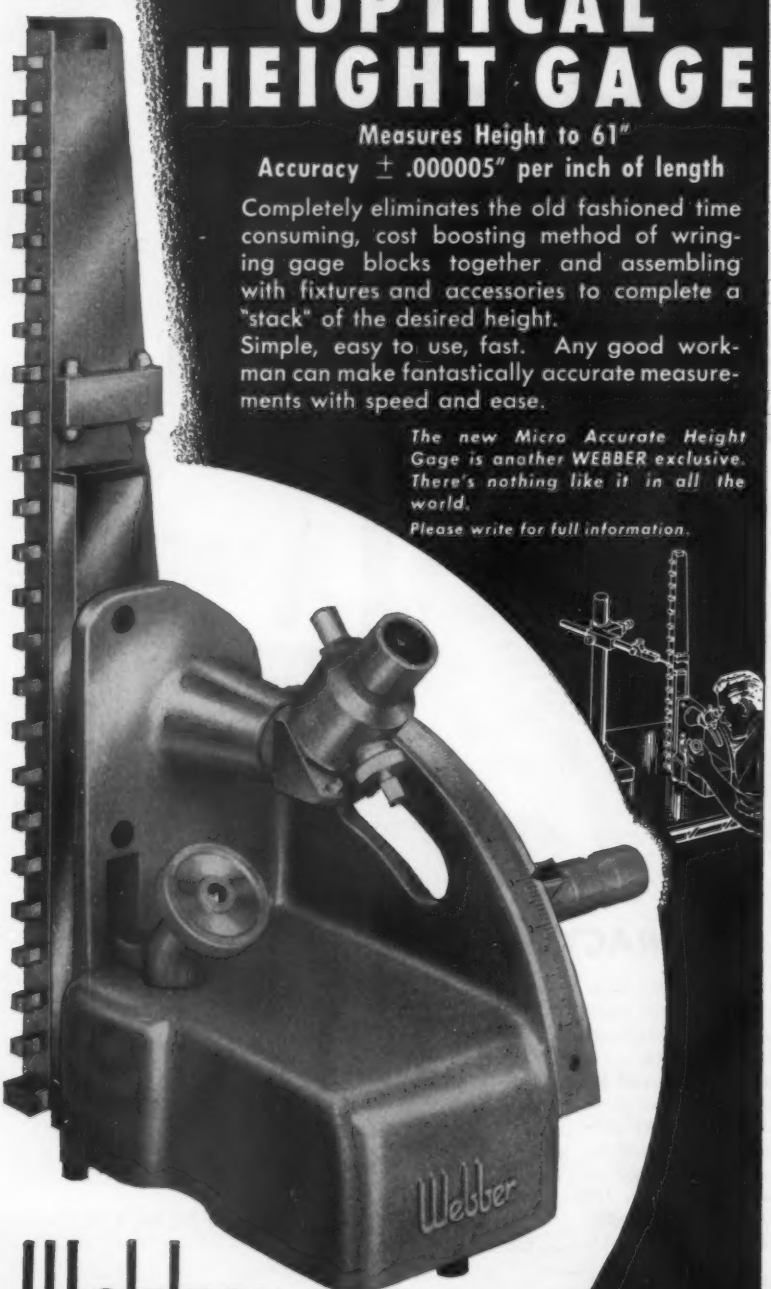

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LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

1200 F for materials as-cast, cast and homogenized, forged and normalized, and forged, normalized, and tempered. Room-temperature properties were also determined.

Among results reported, a modification containing 1.0% molybdenum and 0.7 vanadium showed creep-rupture properties which compared favorably with the best of the columbium-free alloys developed so far.

CONFERENCE ON MATERIALS AND DESIGN FOR LOW-TEMPERATURE SERVICE. *Published by Office of Technical Services, US Dept of Commerce, Washington 25, DC. Order as PB 121009. 400 pages. Price $10.00.*

Although the material contained in this volume dates back prior to 1952, when the conference was held, the book is still one of the few comprehensive collections on this most important subject. It contains the papers presented at the conference, and a comprehensive bibliography.

MACHINE TRADES BLUEPRINT READING (THIRD EDITION)—*By Ihne and Streeter. Published by American Technical Society, 848 E 58th St, Chicago 37, Ill. 172 pages 8½ x 11. Paper bound. Price $2.95.*

The basic principles of blueprint reading are thoroughly and clearly discussed and explained in the first 65 pages of this time-tested work. Particular emphasis is placed on the problems of visualization, in view of the fact that, whereas the draftsman visualizes objects and then represents them by drawings, the man in the shop must employ exactly the opposite technique and visualize the object from the print.

The book has been carefully prepared for classroom use and contains achievement tests for each chapter, becoming increasingly difficult as the student progresses.

The remaining pages, 104 of them, consist of actual industrial prints with corresponding question sheets and space for the student's answer. There are also appendices giving a glossary of machine trade terms, list of common abbreviations, and problems in shop arithmetic.

Names in the News . . .

Jack L Mustard, assistant sales manager of Ex-Cell-O Corp's Industrial Division, Detroit, has been promoted to divisional sales manager.

Theodore Osborne has been appointed manager of Far East and South American sales for Giddings & Lewis Machine Tool Co, Fond du Lac, Wis. He has been serving as district sales engineer for the company's western district.

Horace Singleton, special assistant to the general manager of Robertshaw-Fulton Controls Co's Aeronautical Division, has been made an assistant vice president of the company.

David G Osterer has been elected board chairman of the New Rochelle Tool Corp, New Rochelle, NY. A former executive vice president of Induction Heating Corp, Mr Osterer is also president and chairman of the board of New Rochelle Precision Grinding Corp.

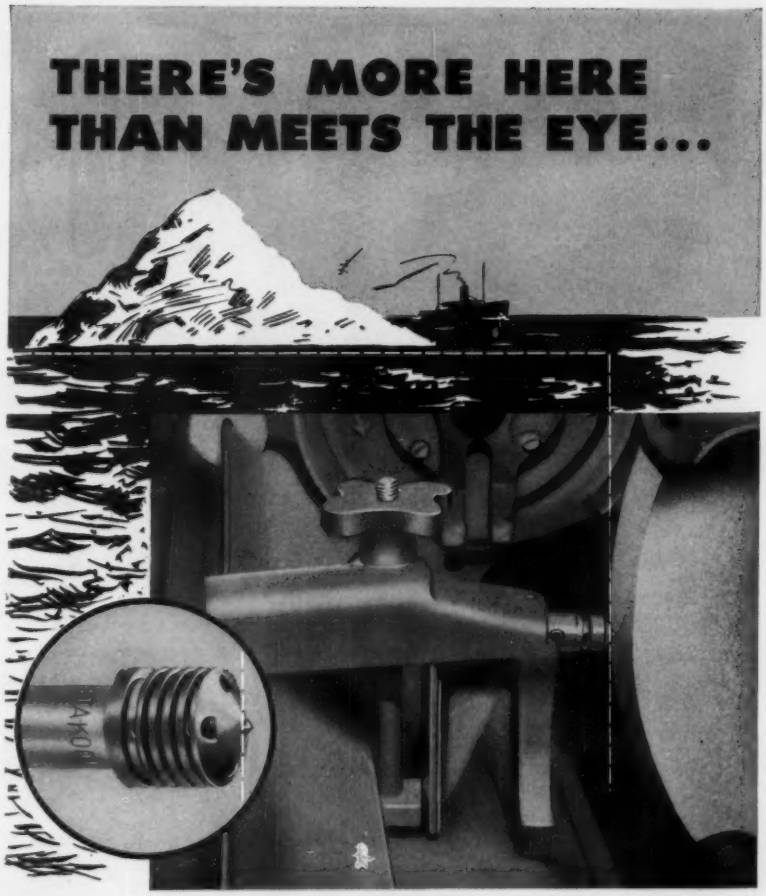
Roy O Schiebel, sales manager of Magnaflux Corp, Chicago, has been elected to the newly-created post of second vice president, sales and marketing.

Edwin F Allison, executive vice president and general manager of Deringer Metallurgical Corp, Skokie, Ill, has been named president to succeed the late **J Paul Deringer,** founder of the company.

John H Locke, Jr, sales engineer at the Philadelphia office of John Bath & Co, Worcester, Mass, manufacturer of taps and gages, has been promoted to eastern district manager with headquarters in Philadelphia.

S T Mackenzie has been elected a vice president of Babcock & Wilcox Co. He will be in charge of the sales department of the Boiler Division.

Robert H McLemore has been elected president of Otis Engineering Corp, Dallas, Tex, and its subsidiary companies. He succeeds **H C Otis,** founder of the firm, who has been named to the newly-created post of chairman of the board of directors. Prior to joining Otis, Mr McLemore was vice president and



In an iceberg or in a J. K. Smit Diamond Tool only a fraction shows above the surface.

Everyone knows about the unseen portion of an arctic iceberg. Many do not realize the unseen factors that lie beneath the surface of a J. K. Smit Diamond Tool, such as . . . our constant research to find still better methods of manufacturing Diamond Tools, the unquestioned integrity of our company since 1888, the manufacturing skills that have been learned and passed on through all those years, and quality control of manufacture for tool duplication.

All these hidden assets count much toward maintaining our position as a leader in the industry today.

When *your* next job specifies a diamond tool for any purpose contact J. K. Smit. Our field representatives are trained and qualified to assist you with any standard or special application.

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
MURRAY HILL NEW JERSEY
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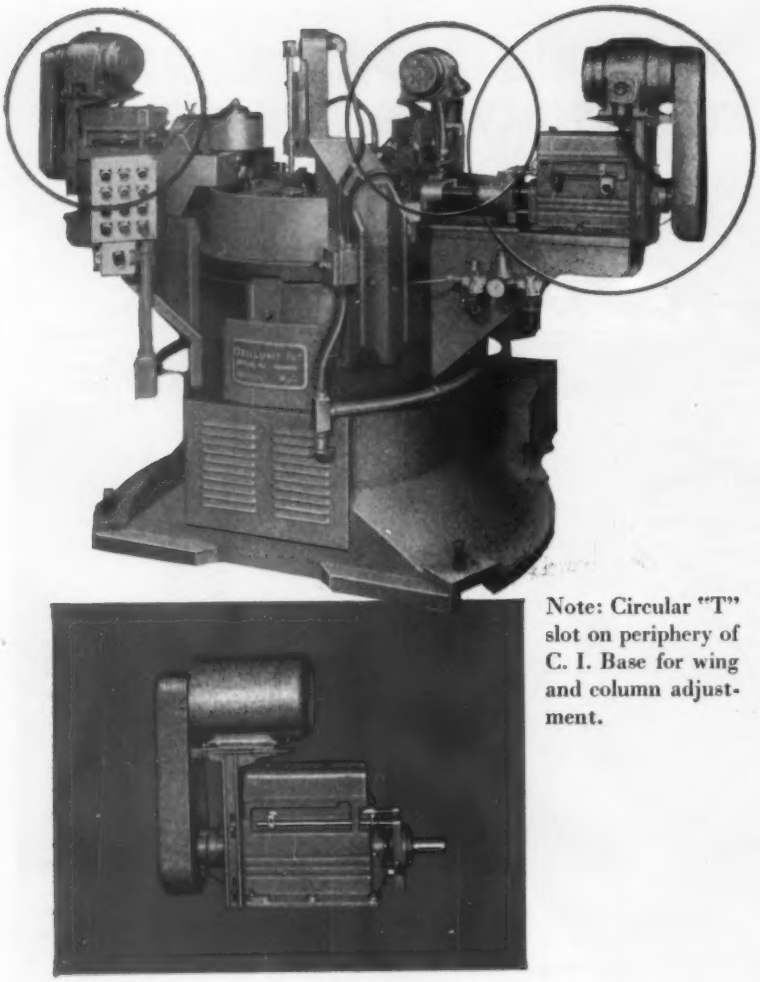
Additional plants in London, Paris, Amsterdam and Toronto, Canada



Note: Circular "T" slot on periphery of C. I. Base for wing and column adjustment.

DRILLUNIT STANDARD MACHINES MEET THE DEMANDS OF PROGRESS

This Drillunit machine is built of a standard base, brackets, columns, table, and the powerful Drillunits outlined in red. Because of this, Drillunit specials never grow old, reconvert at 60% to 80% less cost. Meticulously built by Drillunit of Detroit. Write today.

DRILLUNIT

DRILLUNIT INC., 3267 WIGHT STREET, DETROIT 7, MICH.

general manager of the Turbodrill Division of Dresser Industries. **Herbert C Otis, Jr**, formerly executive vice president and secretary of the corporation, has been elected first vice president.

Maurice R Eastin has been appointed general sales manager of Brush Electronics Co, Cleveland division of Clevite Corp. He was formerly sales manager and assistant general manager of the Perfex Division of General Controls Co.

Andrew Shirmer has been appointed head of S & S Machinery Co's (Brooklyn, NY) newly-expanded rebuilding division. He has been a member of the sales engineering staff for the past 11 years.

William H Uren, purchasing agent, for Sahlin Engineering Co, Birmingham, Mich, has been named operations manager.

G W Stamm, assistant general sales manager of Crucible Steel Co of America, has been named general manager of sales.

Carl E Tack has been named chief mechanical engineer of American Steel Foundries' (Chicago) Transportation Equipment Division. He succeeds **Robert B Cottrell,** who has retired after 42 years of service with the organization.

Herbert T Florence, executive vice president, Cleveland Crane & Engineering Co, Cleveland, has been elected president of the Electric Overhead Crane Institute, Inc. **Frank M Blum,** general sales manager of the Industrial Division of Harnischfeger Corp, Milwaukee, has been named vice president of the Institute.

Alonzo A Neese has been named board chairman of Warner Electric Brake & Clutch Co, Beloit, Wis. Mr. Neese, who succeeds the late **Pierpont J E Wood,** is vice president of the Beloit Iron Works and of Beloit International Corp.

Quentin M Bloom, project manager at Selas Corp of America, Dresher, Penna, has been promoted to manager, Furnace and Kiln Division. **Charles A McFadden,** also project engineer, has been made manager of the General Industry Division.

Joe Doesit, Machine Operator, says:

"I LIKE MY GEOMETRIC DIE HEADS because...

...they never let me down. You see, I'm on piece work and if one of these Die Heads acted up, it would mean the same as a cut in pay. But you can always count on a GEOMETRIC Head to stand the gaff. They're plenty rugged. I like the quick way you can change chasers, too."

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

Photo courtesy The Monarch Machine Tool Company

THE LATHE — *Monarch Series EE Model 1000 Precision Lathe*

THE OPERATION — *The turning of a stub shaft*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
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Since 1851
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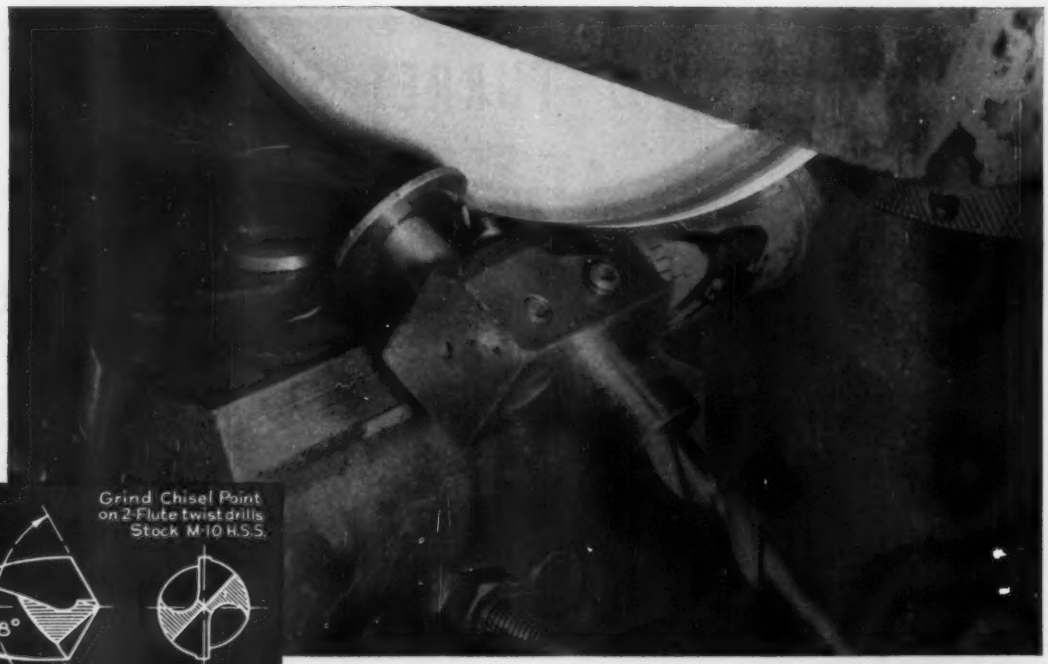
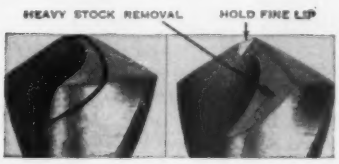
Call Your Horton Distributor Now!



A GRINDING PROGRESS REPORT

Bay State Engineer Finds Way to Triple Production on Chisel Point Grinder

The special "chisel point" on a twist drill makes it start faster in hard materials. Grinding it in one cut and at production rates presents a difficult wheel selection problem, as shown.



For one manufacturer, neither wheels soft enough for the heavy cut nor those hard enough for the fine cutting of the lip could meet the production and quality standards. Expensive overtime shifts were being worked when Bay State was called in.

Bay State District Manager Bob Belmont saw, in this one operation, two grinding tasks so different that one set of wheel "specs" could not possibly do them both.

The "sandwich" wheel illustrated below, with two layers of different abrasives, was his answer. The hard (P grade), fine (220 grit) layer grinds the fine lip. The coarser (150 grit), softer (N grade) side does the heavy cutting.

Bob Belmont demonstrated capable engineering in action. He tripled production, reduced rejects, eliminated overtime, and lowered grinding costs.

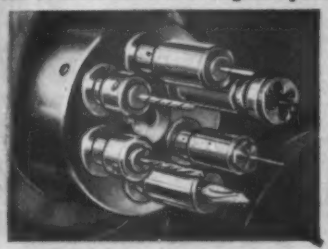
To get such effective engineering aid, contact any distributor or office of the Bay State Abrasive Products Company, Westboro, Massachusetts.

Branch Offices are located in Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.; with distributors in all principal cities.

In Canada: Bay State Abrasive Products Co.; (Canada) Ltd., Brantford, Ont.

BAY STATE
WHEELS of PROGRESS

Detail of drum turret showing six spindles

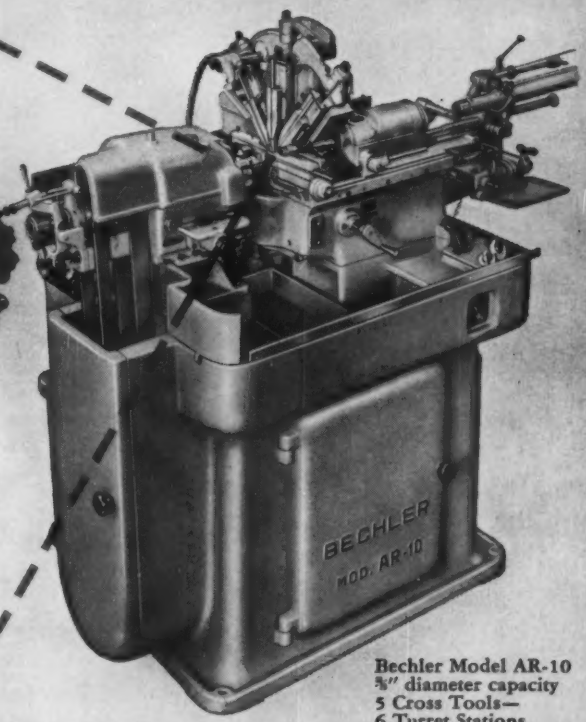


TURRET LATHE VERSATILITY added to SWISS AUTOMATIC PRECISION

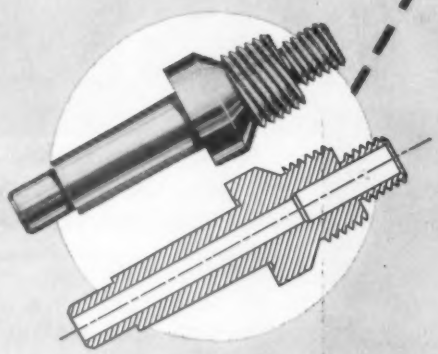
ONE MACHINE COMBINES
6-SPINDLE AXIAL DRUM TURRET
WITH 5 CROSS TOOLS

BECHLER
SWISS AUTOMATICS

This remarkable combination has resulted in a Swiss Automatic of tremendous versatility. Addition of a six-station drum turret permits a wide variety of set-ups with *simple, standard* tools. The 11 separate tool stations permit production of completely finished, precision parts. Secondary operations are eliminated—output is increased—yet the precise performance of standard Swiss Automatics is retained. These machines are available in three sizes with capacities up to 1¼ inches.



Bechler Model AR-10
⅝" diameter capacity
5 Cross Tools—
6 Turret Stations



Steel precision part produced on AR-10. Diameter—.250", length—.750", 1 single and 1 double lead thread, recess and taper behind shoulder, bores concentric with outside diameters.

TURRET FEATURES

- Six adjustable spindles—rotating or stationary—for centering, drilling, reaming, threading and tapping. Up to 4 of these spindles can be tooled for internal or external threads—right, left or mixed.
- Rapid, hydraulic spindle indexing—operated by standard, adjustable trip dogs instead of indexing cams.
- Accurate tool alignment—turret is securely locked on an extra large disc.
- Idle spindle travel reduced—horizontal turret positioned to suit length of workpiece.

COSA — *nationwide sales and service of precision machine tools — from bench lathes to boring mills.*

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New 6" x 18" hand feed

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FOR SHOPWORK OR TOOL ROOM

Completely anti-friction and permanently lubricated machine. Available with all types of attachments found on tool room surface grinders including interchangeable horizontal and vertical wheel heads. A Thompson high quality precision machine at this low price.

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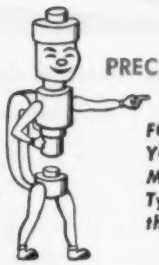

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FOR LOW COST AND QUALITY YOU JUST CAN'T BEAT THOMPSON
Make your next hand feed grinder a Type D Thompson . . . write today for the new descriptive catalog, D-55

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The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

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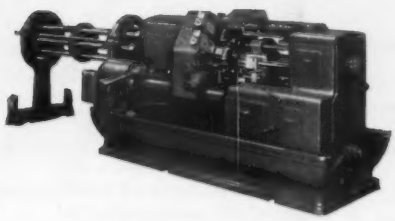

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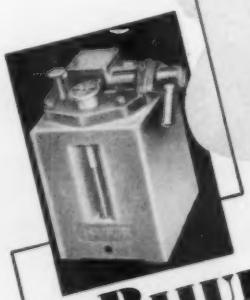

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Hand oiling is costly! It wastes time and money . . . steals valuable production hours . . . means extra down-time, fire risk, repair bills, replacement parts and causes product damage from excess lubricant.

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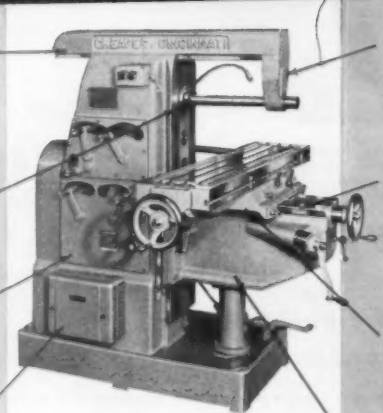

Overarm casting is rigid, boxlike structure; dovetail planed to perfect alignment with spindle.

Spindle and intermediate shafts jig bored for accurate alignment; mounted on over-size Timken bearings.

Heavy ribbed, box type, column casting assures rigidity.

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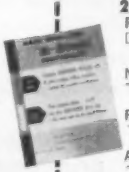

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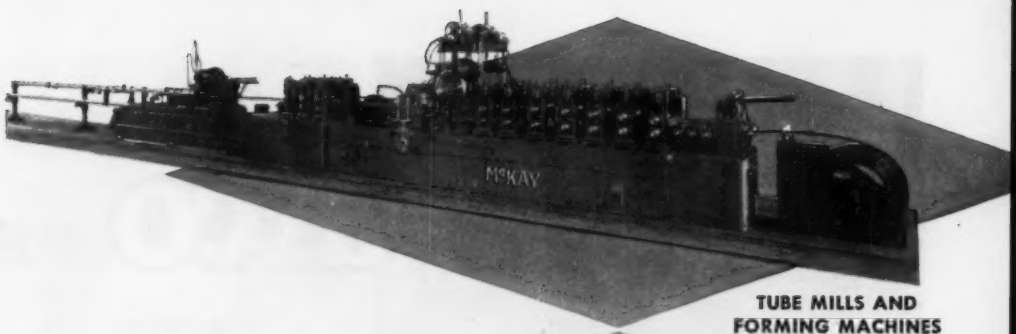
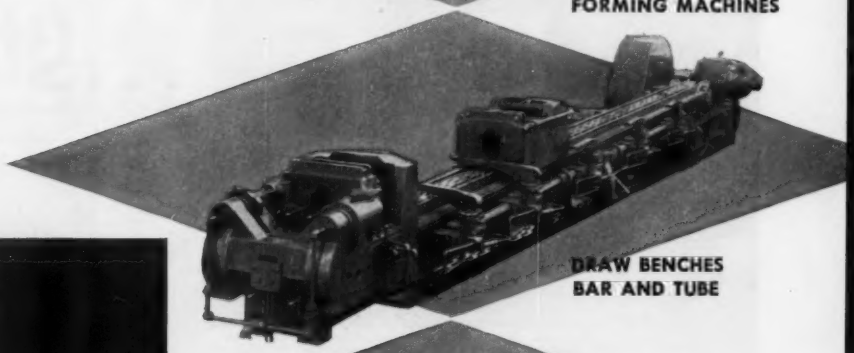
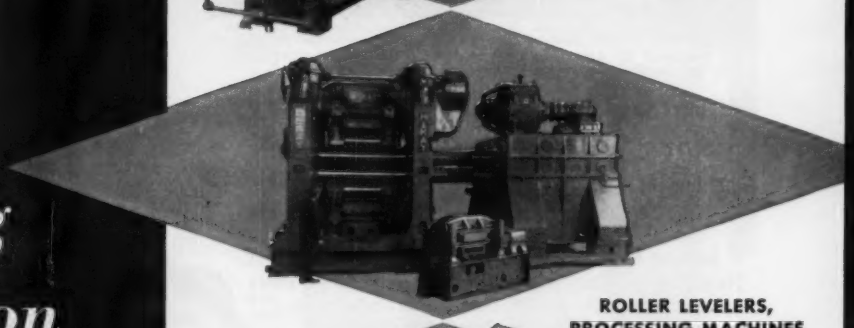


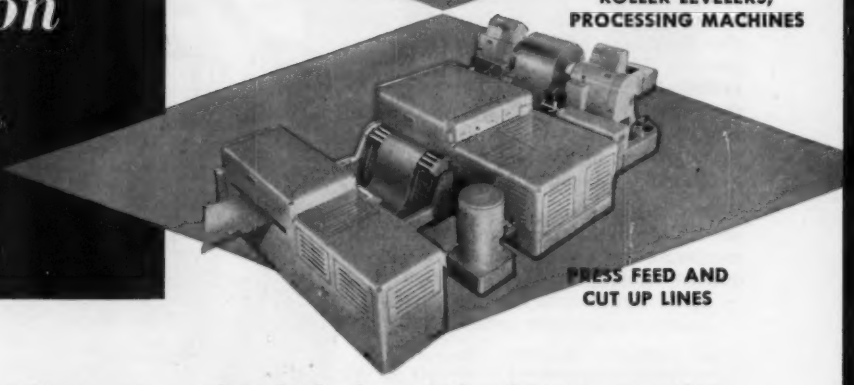
TUBE MILLS AND
FORMING MACHINES



DRAW BENCHES
BAR AND TUBE



ROLLER LEVELERS,
PROCESSING MACHINES



PRESS FEED AND
CUT UP LINES

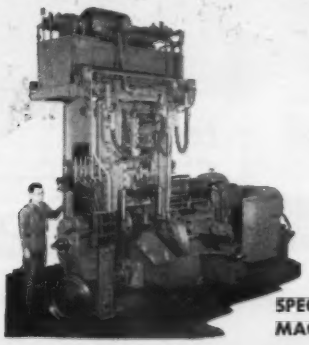
Metal working Automation in action...

If you're in the metal working business, you should be acquainted with McKay *automated* lines available for many metal working operations.

McKay pioneered and has played a leading role in the development of such equipment as that pictured on this page.

Basic McKay designs can be modified, or special machines developed to meet specific requirements.

THE McKAY MACHINE CO., YOUNGSTOWN, OHIO



SPECIAL
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McK

"Warco PRESSES ...Stand up!"

Tongue support part for New Holland baler, prepared with 75-ton Warco inclinable punch press, is shown fitted in place on Hayliner 68 assembly line at New Holland, Pa. Inspecting the job is Sub-assembly Foreman Lee. Larkin.

"Not a breakdown in five years," says leading farm machine manufacturer

• Several years ago New Holland Machine Company, New Holland, Pa., purchased their first Warco Press . . . an inclinable punch press. It is still working as good as the day they bought it. Since then they have added other Warcos for piercing, blanking and forming a variety of machine parts. "We find these presses very satisfactory," say New Holland officials; "in our five years of using Warcos we have never had a breakdown."

Warco Presses stand up because they are built from the frame out to deliver maximum performance in the most difficult assignments.

THE FINISHED PRODUCT... Warco inclinable punch press had a hand in turning out this smart-looking, smooth-performing Hayliner 86 baler. The machine was designed to bring the average-size farm big baling capacity at smaller baler cost.

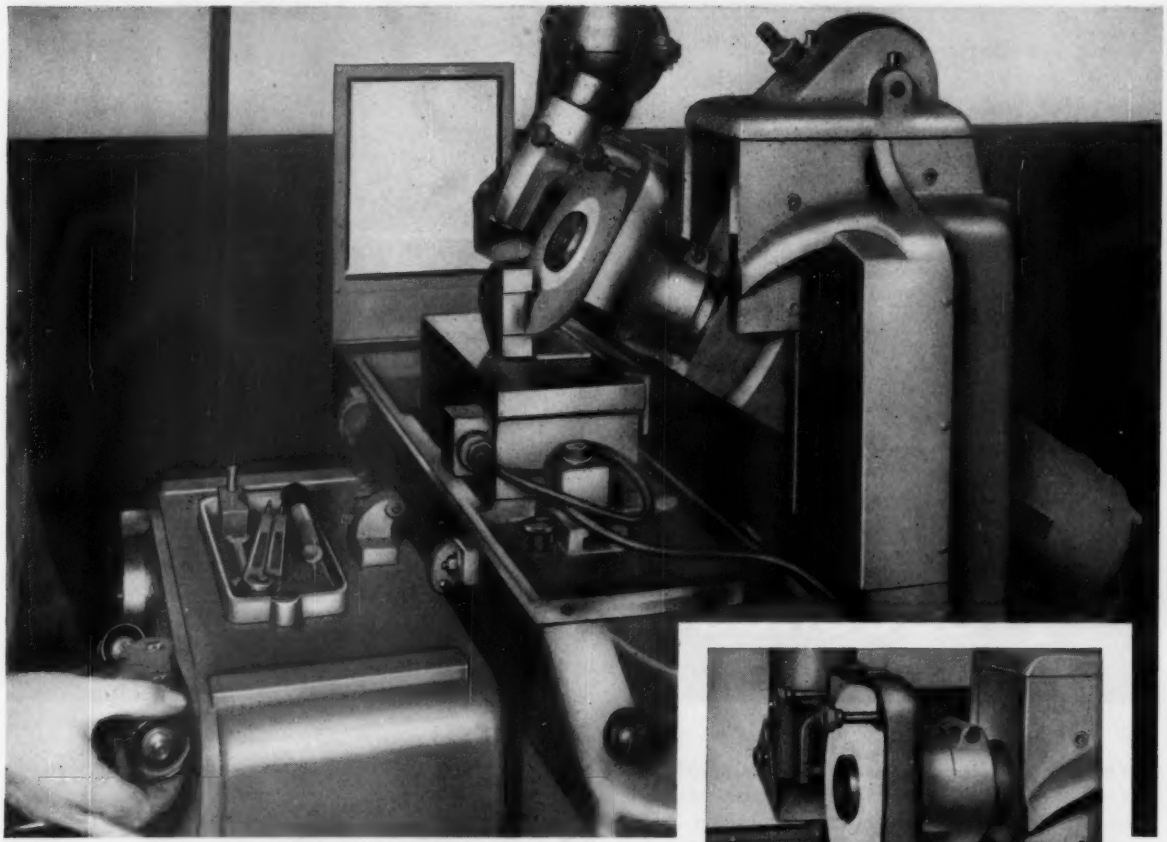
Using a 75-ton Warco inclinable punch press, operator Christian Good turns out tongue support parts. Watching the operation is Assistant Foreman Lester Howe. Ten-gauge hot-rolled sheet steel is used for the part.

Federal® WELDERS

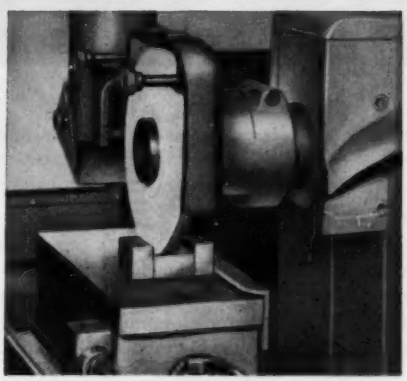
The Federal Machine and Welder Company

WARREN, OHIO

Warco PRESSES®

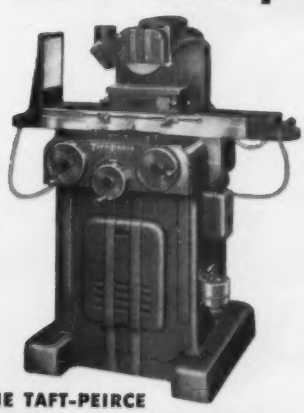


This is the new way — Taft-Peirce angular surface grinding, as compared to conventional side wheel grinding, at right. Workpiece is held on Superpower Electromagnetic Chuck with fine mesh face plate. (Wheelhead cover removed to demonstrate operation.)



T-P Tilting Wheelhead

Cuts Setup and Grinding Time in Half!



THE TAFT-PEIRCE NO. 1 PRECISION GRINDER

Tilting wheelhead is mounted between two pairs of circular dovetail slides, permitting swivelling of the entire spindle about the wheel center — through an arc from horizontal to 30° below center. Spindle can be set to any desired angle to simplify and even eliminate the setups frequently required for difficult grinding operations.

Same workpiece, same operation — but what a difference in time and cost.

Exclusive Taft-Peirce *angular surface grinding* makes it possible to complete a setup and grinding operation in less than half the time required with conventional side wheel grinding. Just set piece on magnetic chuck, dress wheel, and grind! And there's no problem with burrs, working over-size, curved surfacing, or wheel glazing.

All this, plus the extreme accuracy of the No. 1 Precision Surface Grinder. Operators easily grind to .0001″, and to .00005″, with experience. Surfaces are so smooth they seal without lapping; so accurate, they wring!

See these remarkable features demonstrated — we're sure you'll be convinced of the extra savings this grinder will produce. Contact your local T-P representative or write: Taft-Peirce Manufacturing Co., Woonsocket, R. I.

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- Magnetic Chucks
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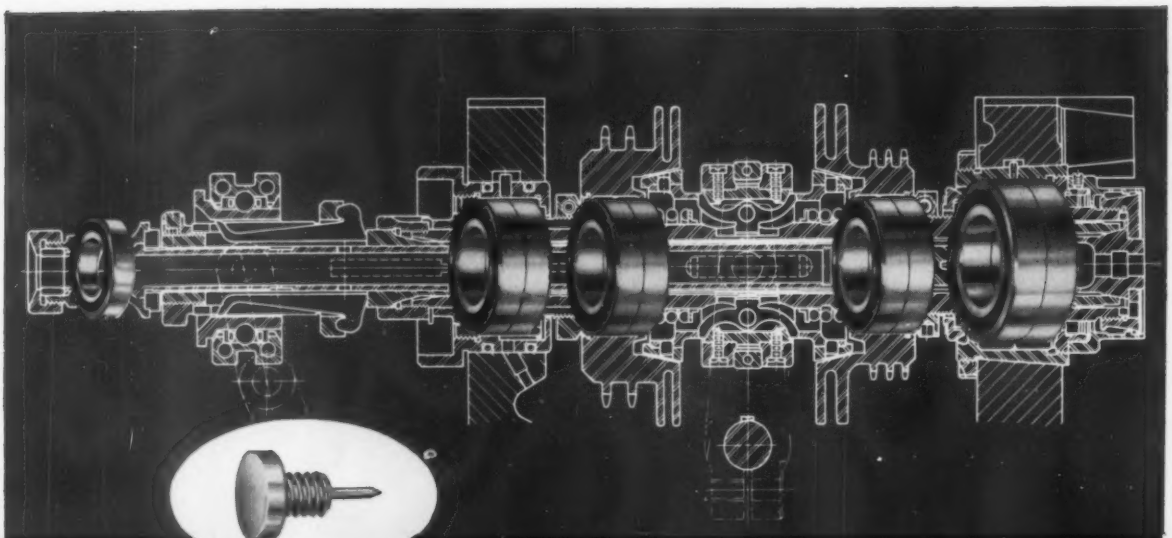
T-P Means TOP Precision



7 seconds from nothing flat!

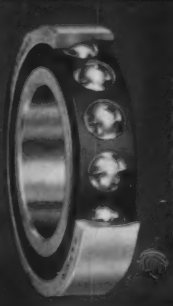
The brass part illustrated below the diagram is produced on the new 00 Brown & Sharpe Automatic Screw Machine in 7 seconds. That represents a 42% increase in production over the previous model.

To step up production by such a substantial percentage involved the development of new and exclusive features for the 00 machine over and above those proven so successful on the previous model. Included among them is the chain-driven, ball bearing spindle . . . see large diagram above.

In the selection and application of the bearings for the 00 spindle, Fafnir engineers worked with Brown & Sharpe engineers. The 208 speed combinations from a high of 7200 RPM to a low of 34 RPM, permitting high cutting efficiency on a wide range of materials, presented no ordinary problem for bearings. The bearing arrangement shown meets an exacting demand for maximum radial and axial rigidity to assure true balance and running accuracy of the spindle.

Could be there's no place in your machines for these super-precision bearings. But, whenever bearings are involved, there's certainly a place in your product planning for the Fafnir "attitude and aptitude" — a way of looking at bearing problems from the designer's viewpoint plus coming up with the right bearing to fit the need. Ask your Fafnir representative for details. The Fafnir Bearing Company, New Britain, Conn.

The New Brown & Sharpe No. 00 Automatic Screw Machine with Fafnir-equipped spindle.



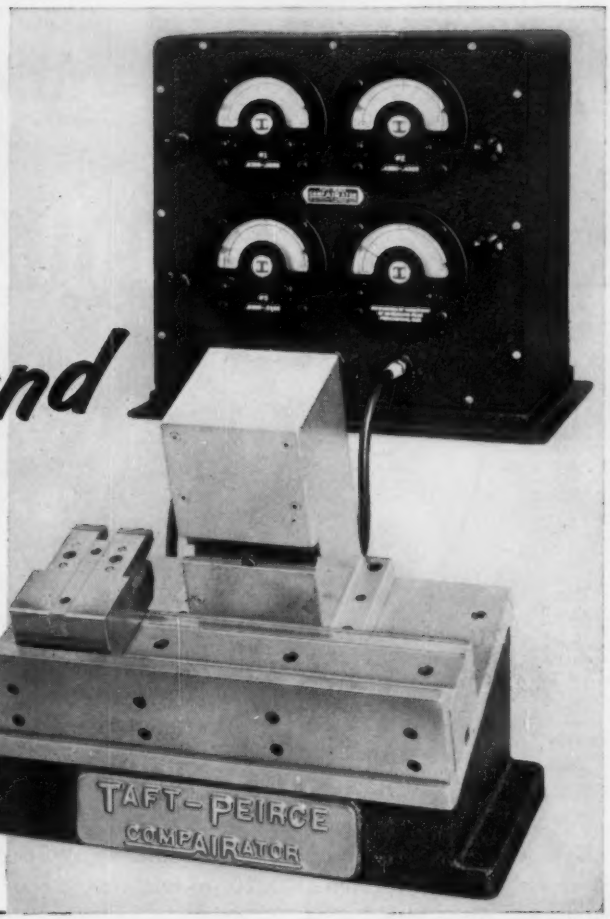
Fafnir preloaded, angular-contact, super-precision ball bearings with composition or brass retainers are made to highest industry-approved tolerances. Single or duplex bearings like this are used widely on spindle applications.

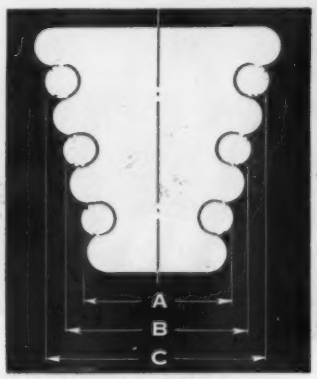
FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

New Taft-Peirce CompAIRator Air Gage

Measures and Computes

4 DIMENSIONS SIMULTANEOUSLY



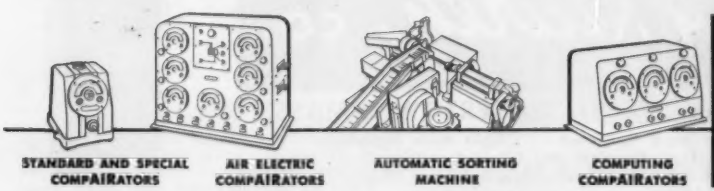


The CompAIRator above checks serrations in the root section of jet engine turbine blades. Does automatically and instantly what formerly took skilled hands many minutes to do.

Three of the air indicators measure thickness "over rolls" of the serrated sections. At the same time, a T-P Computing CompAIRator computes the difference between two of these dimensions and compares it to a standard value. If the variation is greater than plus or minus .001" on the dial, the part is rejected. Most important of all, the serrations can be checked over their entire length.

Two different models of this gage have been built. One permits gaging with the part in the grinding fixture — thus eliminating many costly rejects. The other serves as a final inspection gage.

This unit is typical of the hundreds of Taft-Peirce CompAIRators now simplifying complicated gaging operations. For more information on this and many other items, send for your copy of the Taft-Peirce Handbook.



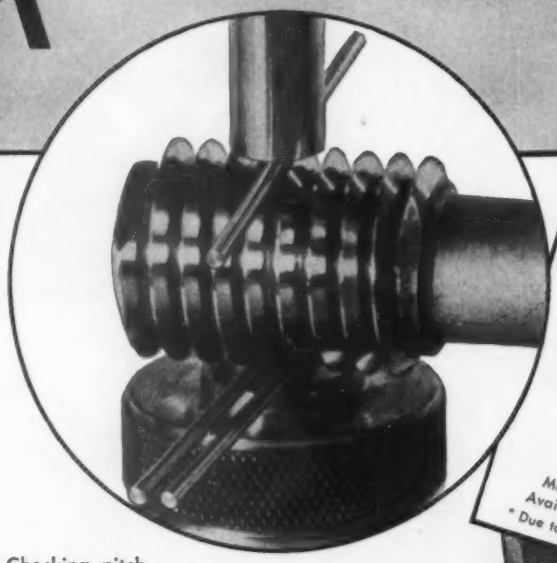
T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

VK THREAD MEASURING WIRES

▼ *Standard equipment everywhere*



Checking pitch diameter of thread gage by three wire method on VK Light Wave Micrometer.

VK STANDARD THREAD WIRES
Now up to 75% INCREASED ACCURACY
IN YOUR P.D. MEASUREMENT
For all standard Unified and American Threads 2 to 80 P
When you order the NEW
VK CALIBRATED THREAD MEASURING WIRES WITH MATCHED CONSTANTS
Max. Theor. Meas. P.D. Error* = .000015"
Available from stock at no increase in price.
* Due to effect of wire diameter

Every set of VK Standard Thread Measuring Wires, in addition to being within .000020" of best size, is now calibrated and furnished with matching constant. In many cases this will result in considerably more accurate pitch diameter measurements. These wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. For the great majority of 60° Unified and American threads, the Set No. 20 H.S. pictured at the right will fill your needs. Similar sets to ± .000020" accuracy are available for single-start threads of other pressure angles. For threads which have a lead angle greater than five degrees, or multiple-start threads and worms, special size wires should be used.

Set No. 20 H.S. Thread Measuring Wires

Set No. 20 H.S. Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

Price, High Speed Steel Wires....$135.00

Special wires from .002" to 2.000" diameter are made to any tolerance required.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

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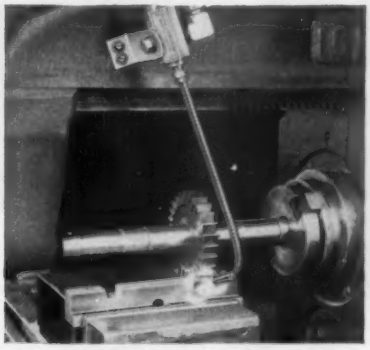
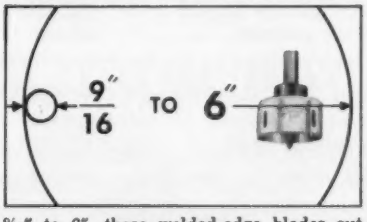
Recent reports by metal cutting specialists indicate that mist cooling produces important benefits in longer tool life, improved work quality and reduced heat distortion of work on a wide variety of operations. Mist cooling systems like the MILFORD Atom-Lube combine compressed air and cutting fluid, producing a fine mist to remove heat from the tool's cutting edge and from the work. This is the major factor in improved tool performance.

The MILFORD Atom-Lube system is a ruggedly designed unit made specially for tough industrial applications. Adaptable to almost any piece of equipment, its range of applications is only limited by the industrial user's imagination. For more complete information about making these savings available for your operations, write to MILFORD . . . a pioneer in mist cooling.

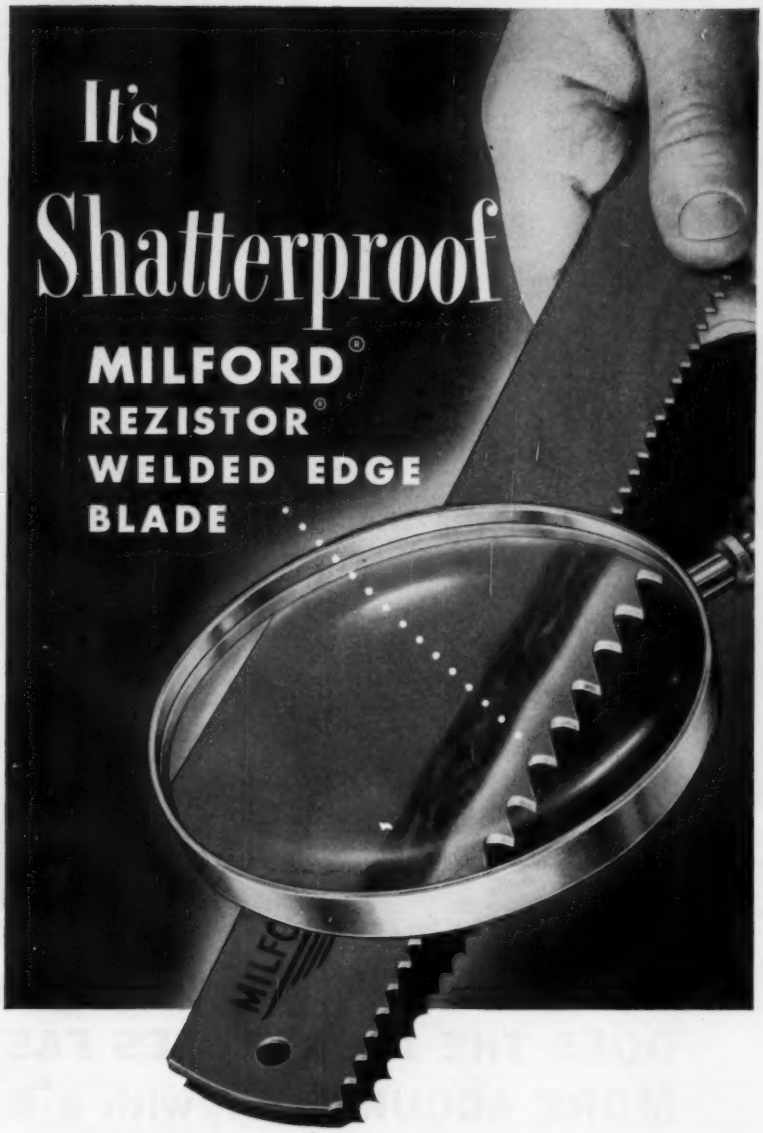


MILFORD Distributors now offering Hole Saw Line

Industrial distributors who carry MILFORD Hack and Band Saw Blades are now stocking the new MILFORD Shatterproof High Speed Steel Hole Saws. Available in a complete diameter range from



9/16" to 6", these welded-edge blades cut clean, round holes in practically any machinable metal or non-metallic. Many manufacturers have investigated their present hole cutting methods, particularly in large diameters, and after comparative tests have selected MILFORD Hole Saws. A new convenience for industrial maintenance work are MILFORD's sturdy metal Hole Saw Kits for popular pipe tap sizes and pipe entrance sizes. Local MILFORD distributors are ready to demonstrate these plumbers' and electricians' Hole Saw Kits, as well as other MILFORD metal cutting saws, to industrial customers throughout the country.



Industry's first choice in *Shatterproof Power Hack Saw Blades,* the REZISTOR WELDED EDGE combines the maximum in safety and metal cutting performance. Three-ply construction provides a cutting edge of high speed steel with teeth as hard, sharp and long-wearing as any all-hard blade . . . and this edge is *WELDED* and *HOT ROLLED* into a back of tough resilient alloy for superior strength and shatterproof qualities.

MILFORD

BUY FROM YOUR MILFORD DISTRIBUTOR . . . a local businessman who stocks the tools and equipment you need. You'll SAVE TIME, CUT BUYING COSTS and REDUCE INVENTORIES.

THE HENRY G. THOMPSON & SON COMPANY • NEW HAVEN 5, CONNECTICUT

Saw Blade Specialists for Over 80 Years

HACK SAW AND BAND SAW BLADES • HOLE SAWS • GROUND FLAT STOCK

Schiess KZ 250 Double Column Vertical Boring Mill machining a 6-station index turntable, 24" high, 96" diameter, used by automotive manufacturer for an automatic machine.

"Our Schiess vertical boring mill DOES THE JOB 3 TIMES FASTER, MORE ACCURATELY, with a BETTER FINISH!"

Hahn Manufacturing Company, 5332 Hamilton Ave., Cleveland

Jobs of increased size and time limitations no longer hold back production at Hahn Manufacturing Company.

The company reports: "Our Schiess machine has already handled a 60" high cast iron cylinder and a 108" diameter ship propeller. We cut production time by using the two boring heads together. For instance, one head can be used for roughing while the other is finishing. Or one head can be used for turning while the other is boring.

"Our operators claim the machine is just about foolproof. They like the cross-rail electro mechanical controls. They also praise the hydraulic pre-selection of speeds, the finger-tip control for direction of feed and rapid traverse, and the all-vertical gear drive. Another thing—no special training was needed. Our regular machinists put it right to work as soon as they learned the controls.

"The Schiess mill does our big jobs just about three times faster, provides a better finish, is more accurate and results in less spoilage."

Get to know this product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you size up this heavy producer for your heavy production needs.

Write for catalog and complete specifications.

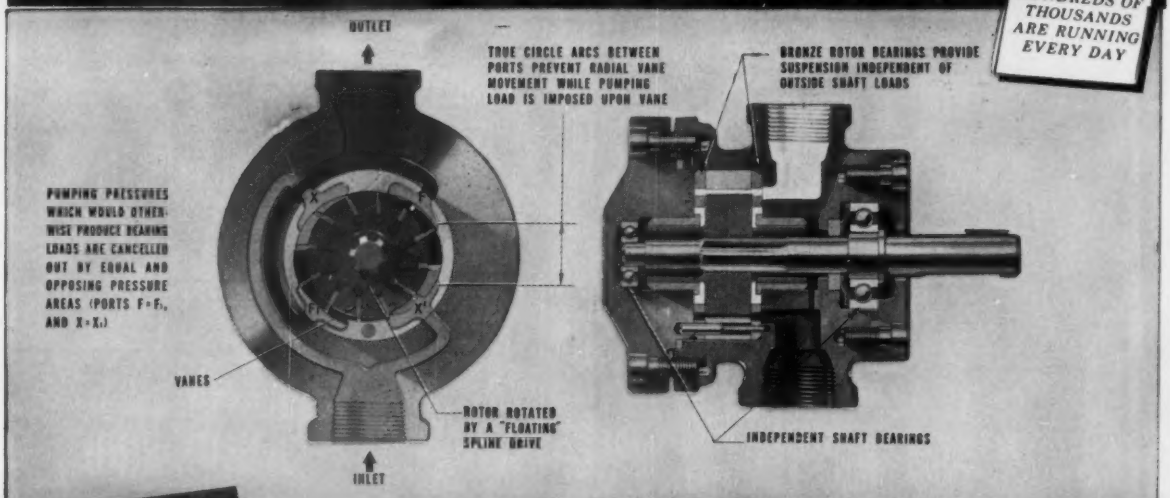
Standard Model KZ Double Column Vertical boring mills are available with 80", 98" and 118" turning diameters.

SCHIESS

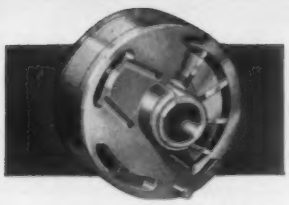
AMERICAN SCHIESS CORPORATION • 1232 Penn Avenue, Pittsburgh 22, Pa.

Question: Why are VICKERS Balanced Vane Type Pumps the most widely used oil hydraulic power pumps?

HUNDREDS OF THOUSANDS ARE RUNNING EVERY DAY


OUTLET
TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
BRONZE ROTOR BEARINGS PROVIDE SUSPENSION INDEPENDENT OF OUTSIDE SHAFT LOADS
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS F+F1 AND X+X1)
VANES
ROTOR ROTATED BY A "FLOATING" SPLINE DRIVE
INDEPENDENT SHAFT BEARINGS
INLET

Answer: Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.



For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (see below) are *the most widely used of all pumps in oil hydraulic service.*

Above is the pumping cartridge which is one of this pump's distinctive features. The many advantages listed at the right merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1410 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated. Pressure-balanced porting plates maintain ideal running clearances.

FLOATING SPLINE DRIVE—Rotor is driven by a "floating" spline. Rotor and shaft have separate bearings . . . avoiding strain from drive misalignment.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

ABILITY TO TOLERATE DIRT—Clean oil is of great importance in a hydraulic circuit; but, in spite of care, dirt sometimes gets in. The Vickers Vane Type Pump will pass a reasonable amount of dirt without trouble and without grinding it up.

REPLACEABLE CARTRIDGE—Cartridge (illustrated above left) contains all pumping parts that move . . . none contact the housing. Working parts can be removed and inspected without disconnecting piping or drive coupling. Replacement cartridge kits are available and pumps need not be sent to the factory for repairs. Pump capacity can be changed by simply changing cartridge in the field.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

MINIMUM MAINTENANCE—Hydraulic balance . . . floating spline drive . . . independent bearings . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life. Then, a new cartridge completely rejuvenates the pump.

CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin 5002A.

7182

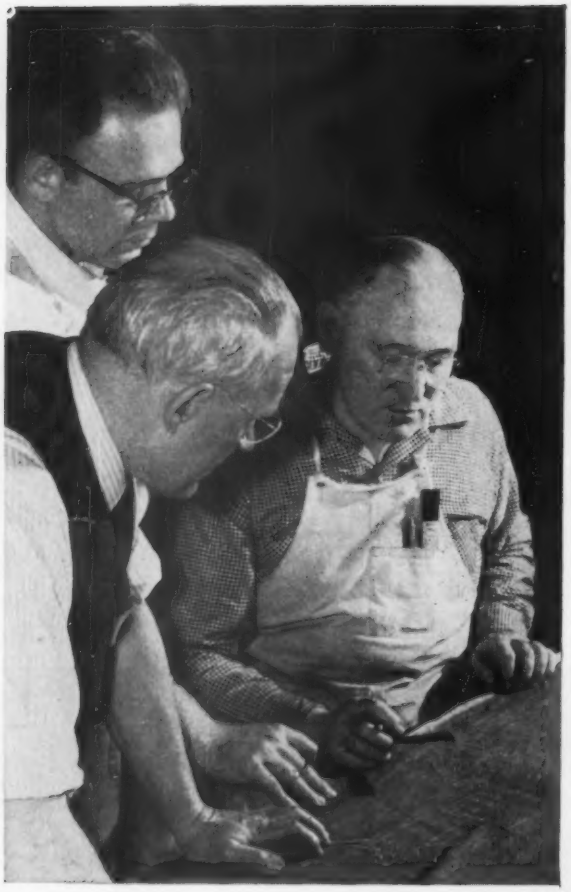
ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

Single Stage. Pressures to 1,000 psi. Capacities to 55 gpm.

Two Stage. Pressures to 2,000 psi. Capacities to 55 gpm.

Double Pump—Two pumps for separate circuits driven by common shaft.

Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.



it's a job for CDT

Faced with a special tooling job? Stymied by a tough problem? Would 50 years of experience help? Then the logical answer for you is to send it to Columbus Die-Tool! CDT specializes in tools, jigs, fixtures and also special machinery, designed and built to produce your products better, faster, and more economically.

That's why so many of the nation's leading manufacturers avail themselves of the specialized services of Columbus Die-Tool. Perhaps CDT can solve your tooling problem and help you make your product . . . better for less.

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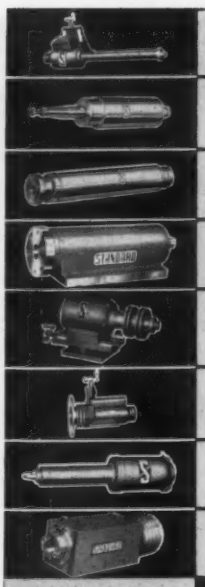
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*



WHEREVER SPINDLES ARE NEEDED, STANDARD SUPPLIES THE FINEST!

SINCE 1912

STANDARD

TRADEMARK OF METALWORKING THROUGHOUT THE WORLD

the STANDARD electrical tool co.

MAKERS OF 800 DIFFERENT SPINDLES . . . AND READY TO DESIGN 1000 MORE FOR INDUSTRY'S NEEDS!

WRITE TODAY: SUPER PRECISION SPINDLE DIVISION

2480 RIVER ROAD • CINCINNATI, OHIO

TANNEWITZ

VARIABLE SPEED TOOL ROOM BAND SAWS AND HIGH SPEED METAL CUTTING BAND SAWS . . . SINGLE OR VARIABLE . . . 50 TO 15,000 FPM. PRODUCT OF MORE THAN 50 YEARS OF SPECIALIZATION. Write or phone.

The TANNEWITZ WORKS Grand Rapids, Michigan

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301B NORTH 11TH ST., ST. LOUIS 6, MO.

from Johnson's Wax Research

A great idea changes old ideas about coolants

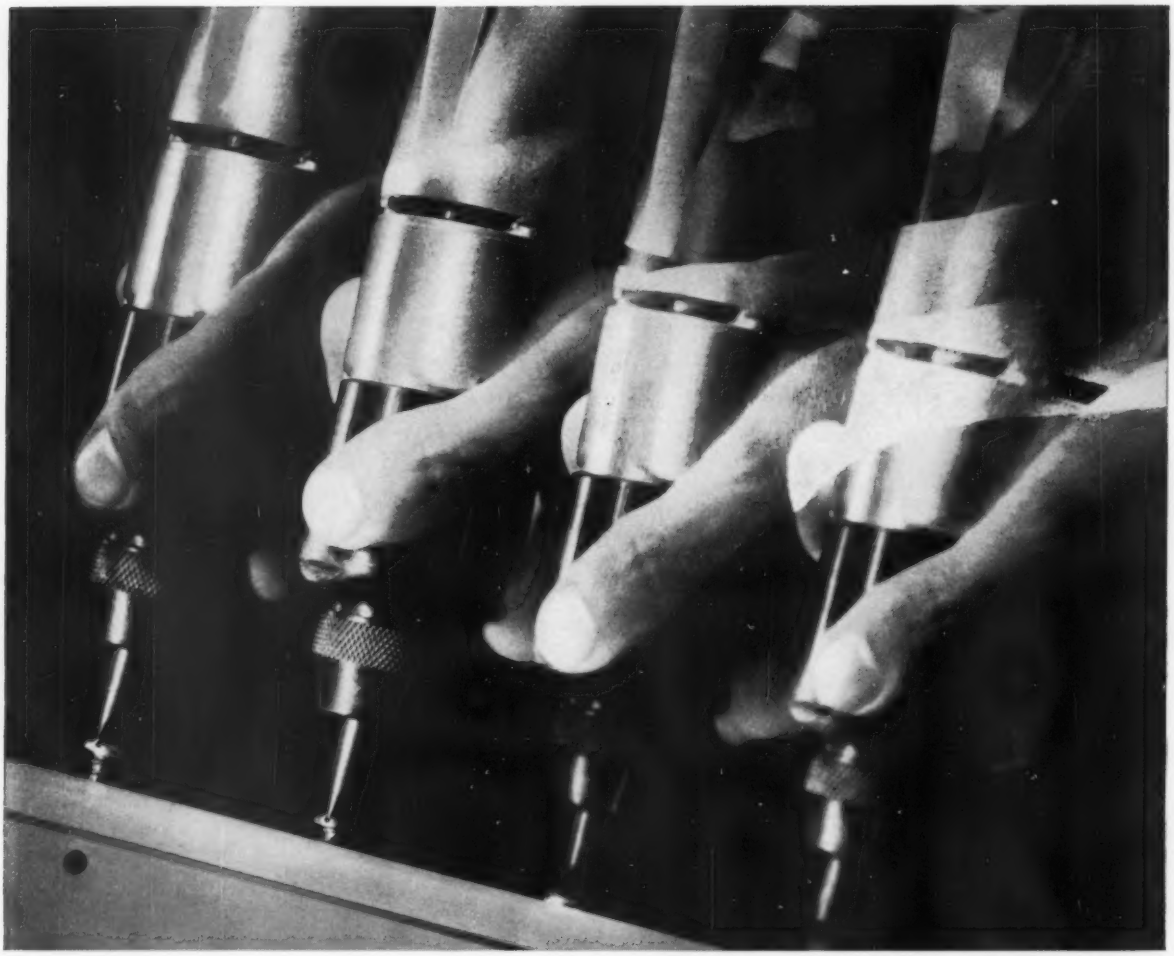
The use of waxes and wax-type synthetics brings coolants up from 1900 to 1957 standards! This great idea is a result of Johnson's Wax Research. Today, Johnson's Metalworking Fluids give superior performance wherever used for machining, grinding and forming. The tougher the job, the better Johnson's performs in comparison with conventional coolants . . . because Johnson's continues to lubricate and cool even under conditions where ordinary coolants fail because of extreme heat and pressure.

You'll find Johnson's in use in shops across the country with proven performance. See what they can do in your shop to reduce costs and to increase profits.

Johnson's complete line of Metalworking Fluids is available from your local Johnson's industrial distributor. Contact him today for an in-your-shop test. Ask him about Johnson's money-back *Guarantee of Superior Performance* over ordinary coolants.

S. C. Johnson & Son, Inc.
Industrial Division, Dept. C-57, Racine, Wis.

Pictured to the right is Johnson's WAX-CUT, one of the complete line of modern cutting fluids for today's high-speed automatics.



Is assembly one of your largest production costs?

It probably is. Wherever fastenings must be made, this simple truth applies: The cost of the fastener is but a tiny fraction of the cost of using that fastener in production. The key to reduced assembly costs is the fastener that helps high-paid assembly hands turn out better work—*faster*. The P-K® Self-tapping Screw is that fastener!

Using screws that don't come up to P-K standards can raise total assembly costs as much as 25%. Screw failures not only result in assembly slow-downs . . . but in parts spoilage and hidden weaknesses as well.

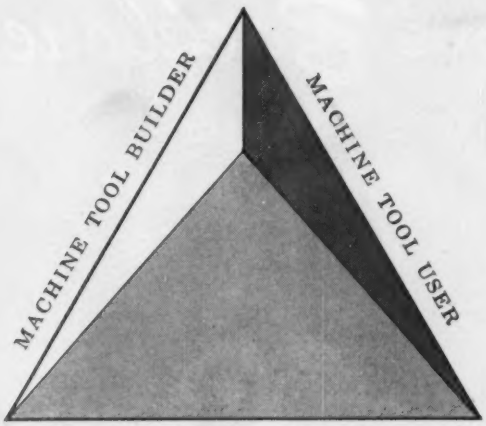
This is especially true in assembly by automation. Uniformity, such as P-K Self-tapping Screws offer, is automation's prime requirement for trouble-free assembly.

Why not talk to a Parker-Kalon Assembly Engineer —a man who is in daily contact with many different assembly set-ups. Perhaps he can show you how to reduce the number of fastenings in your product or how to solve a particularly difficult fastening problem. (That's his business.) Contact him through your local Parker-Kalon distributor.

PARKER-KALON DIVISION, General American Transportation Corporation
Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws

PARKER-KALON® fasteners

Sold Everywhere Through Leading Industrial Distributors
Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California



THE AUTOMATION PYRAMID

The very essence of automatic metalworking and part transfer is CONTROL. And, for greatest effectiveness, control must be an integral part of the basic design of the system—not a belated afterthought.

Thus, the Automation Pyramid rises from a base that incorporates the concurrent efforts of the user, the machine tool builder and the "autometrologist"*. Each contributes essential knowledge and experience that is exclusively his.

The user alone can define the task by specifying the design, quality and production rate of the product to be made.

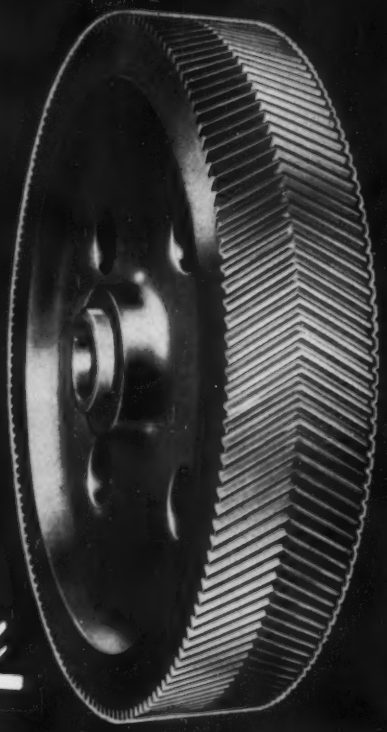
The machine tool builder defines the sequences in metal removal, the speeds and feeds. The "autometrologist" is responsible for the choice and combination of sensing, measuring, prediction, feedback, machine control and assembly operations.

Before embarking on your automated project, take advantage of Sheffield's extensive experience in "Autometrology". It will save much valuable time and reduce operating cost. Write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., **Dept. I.**

**AUTOMETROLOGY*—*The science of combining machining, motion or memory with automatic measuring.*

7709

continuous *Backbone* teeth...



give *you*

these advantages...

Added strength, plus increased load-carrying capacity in smaller space result from the famous "backbone" construction of these gears (formed where the helices meet), where the full face width of each gear tooth is put to work. Because the continuous teeth of all Phillie Gear herringbones are accurately generated on the most modern machines, these gears assure smooth, continuous and highly efficient gear operation . . . year-in and year-out.

If you have a problem involving high horsepower speed reduction under heavy shock loads, specify Phillie Gear Continuous Tooth Herringbones, and be assured of quiet, vibration-free, long-lived transmission of power, for both speed reducing and speed increasing applications.

Learn more about these outstanding gears by requesting Catalog # G-655.

phillie gear®

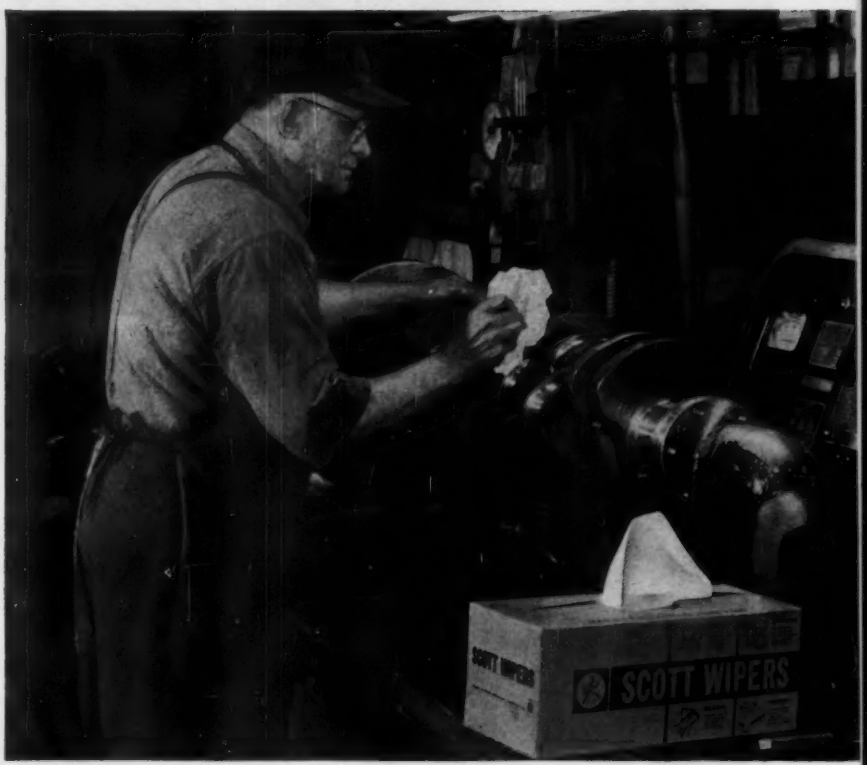
PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.



Scott Wipers are 2-ply paper sheets, welded for extra strength. They're chemically treated for proper wet strength. Their special "perf-embossed" surface makes them ideal for the toughest wiping jobs . . . such as wiping oil off a crankshaft after Magna-Flux inspection.

WIPER PROBLEM? Look what Ohio Crankshaft did with Scott Wipers!

The Ohio Crankshaft Company, Cleveland, is the world's largest manufacturer of heavy-duty crankshafts and camshafts. Two years ago, this company switched from cloth wipers to Scott Wipers. The change pleased employees, increased efficiency and saved money.

Management says: "We save over $1,000 a year by using Scott Wipers." Machine operators use them to wipe tools, stock, machines. Inspectors polish finished parts with them. Workers also prefer Scott Wipers for a variety of other wiping jobs—and they've found that minor injuries have dropped. When used fresh from their "pop-up" box, Scott Wipers carry no metal chips or particles to cut hands and faces.

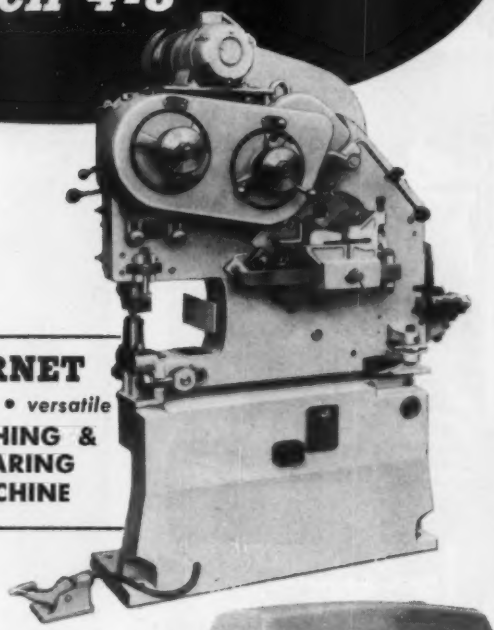
Like more details? Call your local Scott man, or write: Scott Paper Company, Department AM-72, Chester, Pennsylvania.

SCOTT PAPER COMPANY

Makers of the famous Scott paper products you use in your home.
Consult local TV schedules for Scott's program, "Father Knows Best."

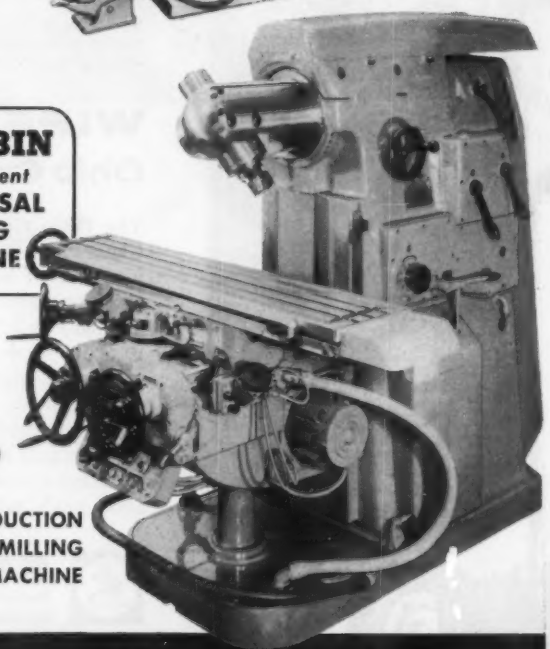
EXHIBITION OF
Modern • Versatile
MACHINE TOOLS
MARCH 4-8

G S P
Highly maneuverable
RADIAL DRILL



VERNET
Powerful • versatile
PUNCHING & SHEARING MACHINE

Versatile, precision-built machines for quality production . . . they have won favor and cut costs in shops and leading manufacturing plants throughout the world.
Be sure to see them demonstrated at the exhibition March 4th to March 8th . . 7801 Brookpark Road, Cleveland, or write for folder 10A.



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An excellent
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High output of precision manufactured
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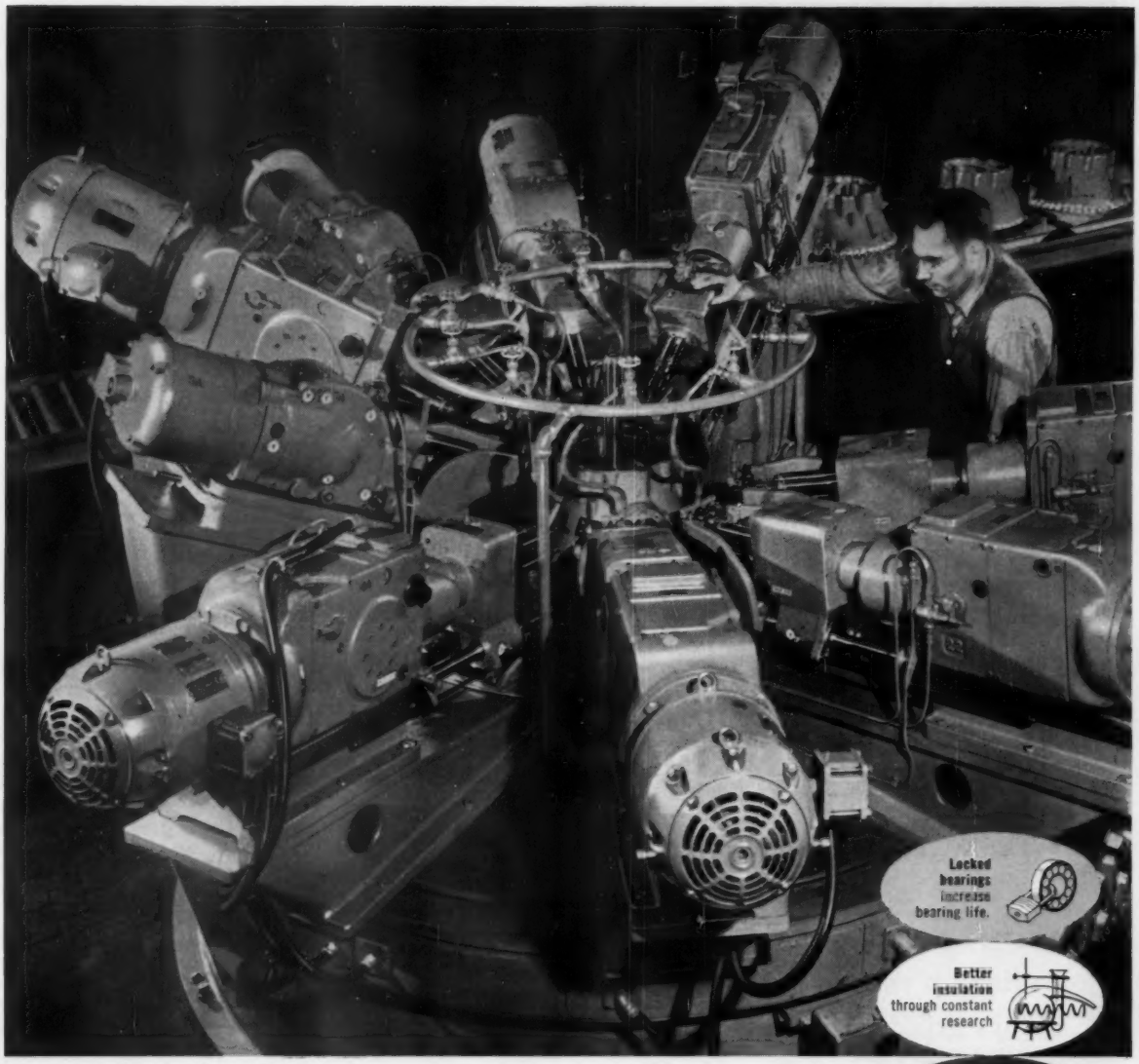


9-armed automation

Tailored for precision metal-working, Louis Allis motors help speed production

You've got to have motors that can take the tough duty cycles required by multiple-purpose, automatic machine tools, such as the machine pictured above.

You'll be wise to specify Louis Allis motors on your machine tools, where they can boost your production.

Louis Allis special motors can be matched to your metalworking operations to provide high torque, quick acceleration, fast stops, and rapid reversal — in almost any sequence to match your duty cycle.

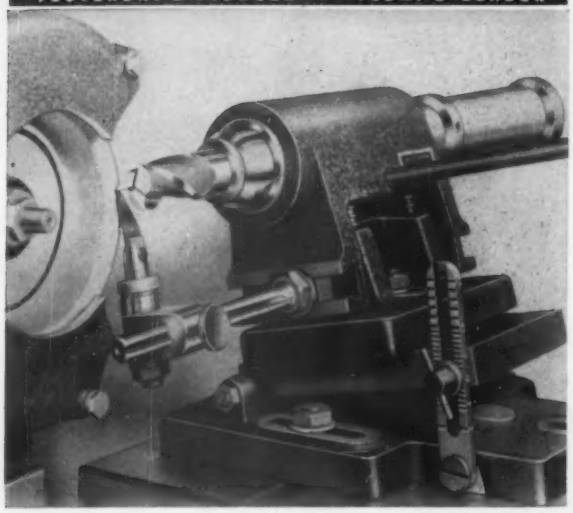
Need help? Well, don't wrestle with your drive problem alone. There's a Louis Allis sales engineer, expert on machine tool and metal working motor applications, who'll gladly help you.

Contact your Louis Allis District Office or write to The Louis Allis Company, 452 East Stewart Street, Milwaukee 1, Wisconsin.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

YESTERDAY'S PIONEER . . . TODAY'S LEADER



WELDON
End Mill Sharpening Fixture

• The Weldon Sharpening Fixture quickly resharpens end mills from 1/16" to 2" inclusive. Unnecessary to line up the fixture as it will always grind straight. Designed for any grinder with flat table. No table movement necessary.

Requires little skill to operate. Increases life of end mills and improves their performance.

Write for Circular

Weldon distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

IT'S PLAIN TO **see**

A Boring Head That Won't Face is NOT Complete

NOW you can get a boring head that will BORE, FACE, TURN and GROOVE at no more cost than you would pay for a plain, single purpose boring head.

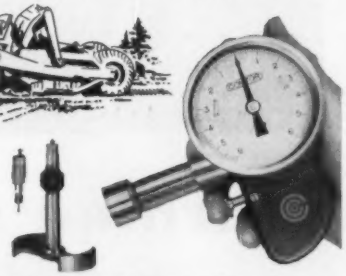
LOOK INTO THIS before you buy that new head. Write for full details.

CHANDLER TOOL CO.
Muncie, Indiana, U.S.A.

Chandler-Duplex
COMBINED BORING AND FACING TOOLHEADS

Did you know that – – –

Heavy machinery builders use this gage extensively for Quality Control



Precision Internal Gage
SIZES FROM
1/8" to 10"
AND LARGER

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 10" dia.

UNIQUE ADVANTAGES

- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
- Indicates actual size, a fixed — not passing — reading.
- Positive 2-point gaging — automatic centering.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Will gage work in the machine.
- A shop tool for all-day every day use.
- Portable — no wires, hoses or stands.

Approximately 40 leading road machinery manufacturers employ COMTORPLUGS for precision checks of bores up to 10" diameter, to tolerances in ten-thousandths. IT MAKES PRECISION GAGING EASY . . . at machines . . . at inspection bench . . . for selective assembly. No other like it — investigate and see why.

COMTOR COMPANY
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GET THE FACTS — REQUEST BULLETIN 50

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Factor of Safety— make it a reality

You can't calculate that with a bolt having yield strength of 4 times the working load you're automatically getting a *safety factor* of 4. Far from it. Only when the bolt is *tightened* to four times working load do you get it.

That's because rigidly fastened members can be externally loaded to the full value of residual tension in bolts without any separation or extra bolt stress.

Suppose you need a bolt for a 5000 lb. working load. For a X4 safety factor, you use a bolt of 20,000 lb. capacity, and tighten it to 20,000 lb. tension. If you tighten to only 10,000 lbs., any external load larger than this causes loosening, and progressive bolt failure from fatigue. So your safety factor is really only 2.

PRODUCTION MAN FOLLOW-THROUGH IMPORTANT

Factor of safety, then, is not established on the drawing board. It can only be put into the product by the shop man with wrench. In short, a bolt is no better than the supervision of its tightening.

A NOTE ON FLEXIBLE JOINTS

This case is different. You tighten such a joint just to working load. So use a bolt capable of this *plus* any added stress *multiplied* by your safety factor.

How to simplify bolt and nut usage

DESPITE their now unified dimensions, "standard" fasteners number thousands upon thousands of different types and sizes. More and more companies are beginning to realize that *usage* simplification offers advantages.

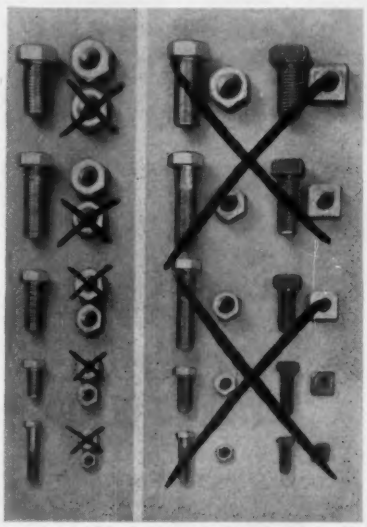
EXAMPLES

A well known electrical manufacturing company finds it no handicap to eliminate all 1/16" bolt sizes above 3/8", thereby simplifying production and purchasing.

One engineering firm eliminated 1700 different fastener items from inventory by determining that the jobs could be done as well by other sizes or types.

SOME SUGGESTIONS

To guide your thinking, RB&W points up the following ways to simplify: (1) Forget thread fits for all but specialized needs – standard "tolerance fits" have thoroughly proved themselves. (2) Why adhere to double thread standard when coarse threads prove stronger and assemble faster? (3) Stick with hex head bolts – they do better jobs than square. (4) It can save money to change diameter or length, rather than to add another item to stock. (5) Two standard physical grades meet most load range requirements – do you really need special alloys? (6) Heavy nuts really belong with larger size bolts – use finished nuts with the smaller sizes.



Here is a graphic display of possible simplification. From a typical array of fasteners, it shows what may be superfluous for meeting the requirements of proper fastening in a great many instances.

RB&W would be happy to enlarge on these facts, and help you simplify fastener selection to get proper joint strength and cut assembly time and inventory. Write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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At one company's plant, a large, heavy-duty crane had deteriorated due to rivets loosening. Replacing with new rivets was no permanent answer, but RB&W high tensile bolts were.

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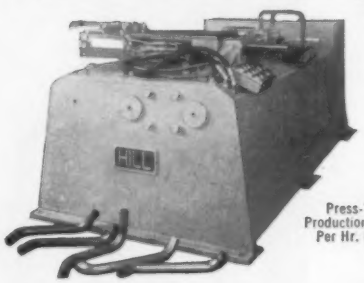

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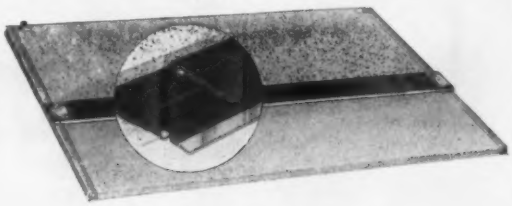

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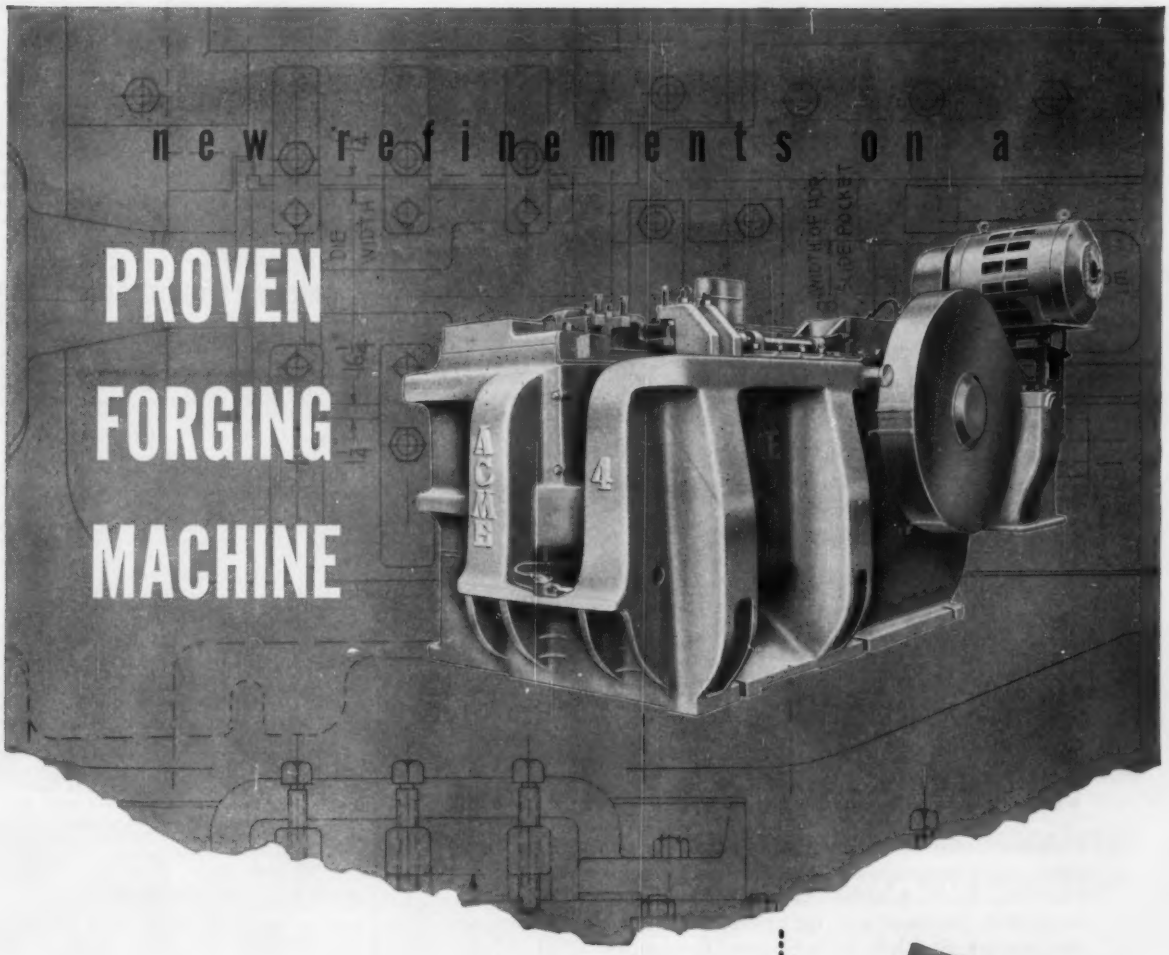

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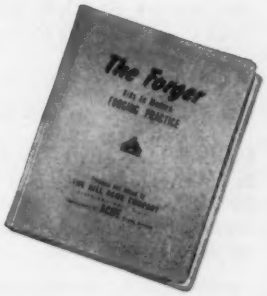

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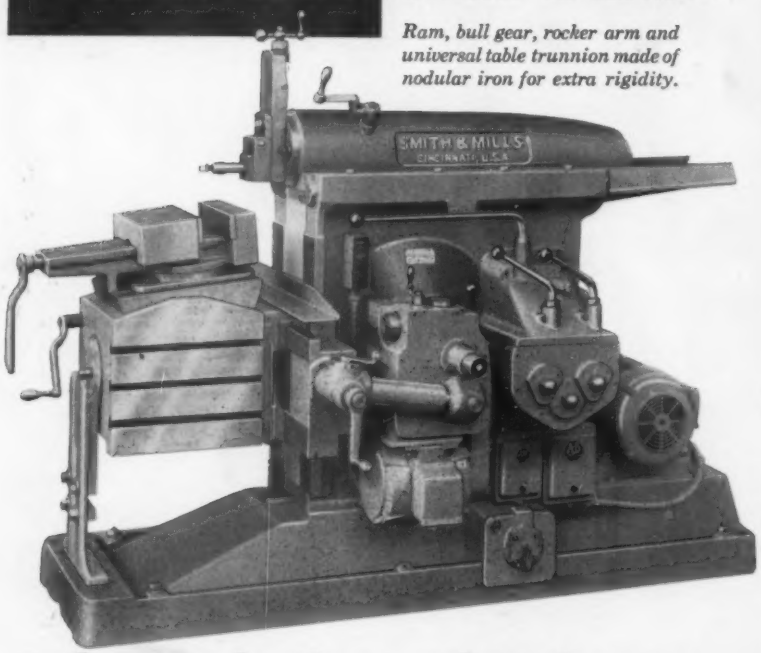

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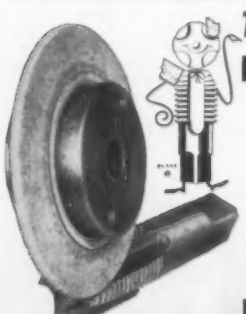

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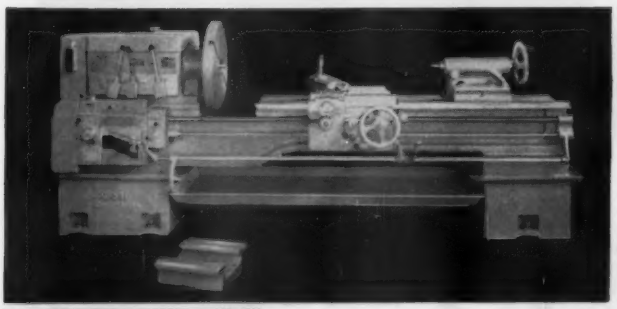

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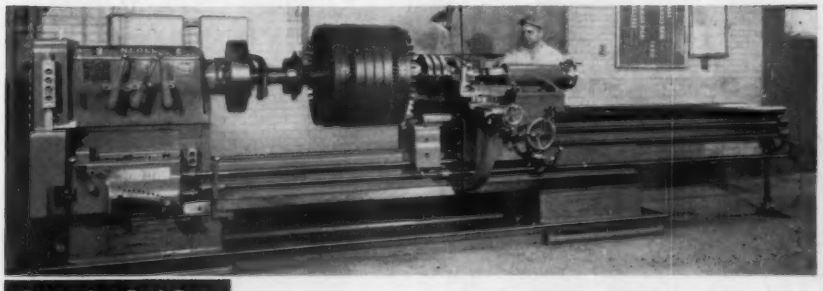

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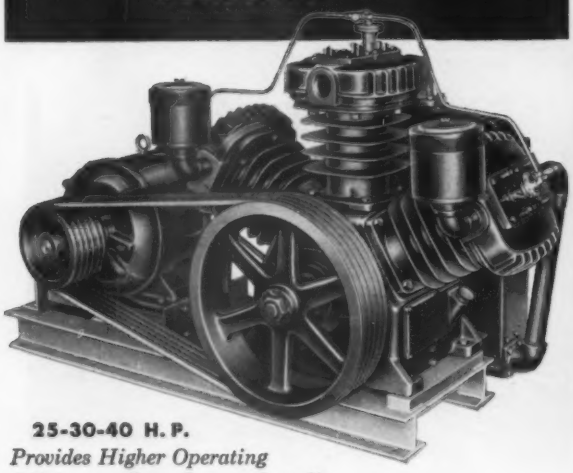

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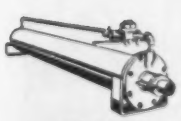

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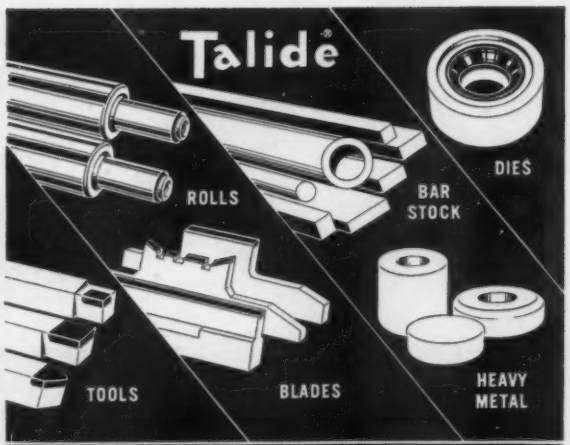

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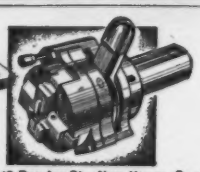

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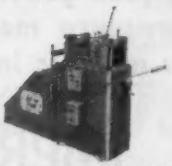

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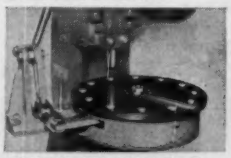

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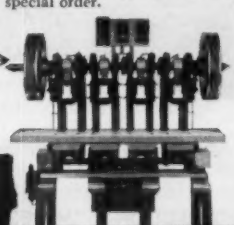

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Strokes/min

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Strokes/min
GEARED
50-100
Strokes/min

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GEARED
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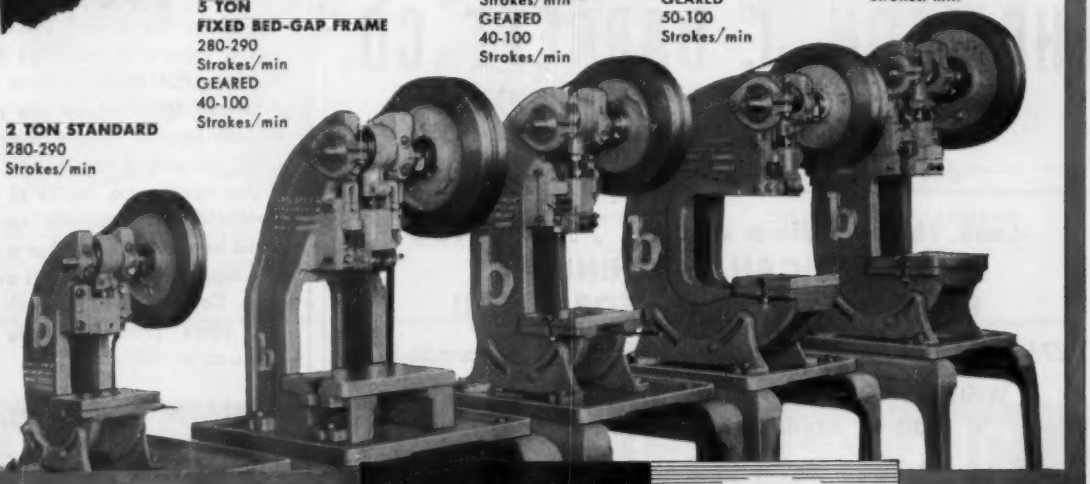
Strokes/min



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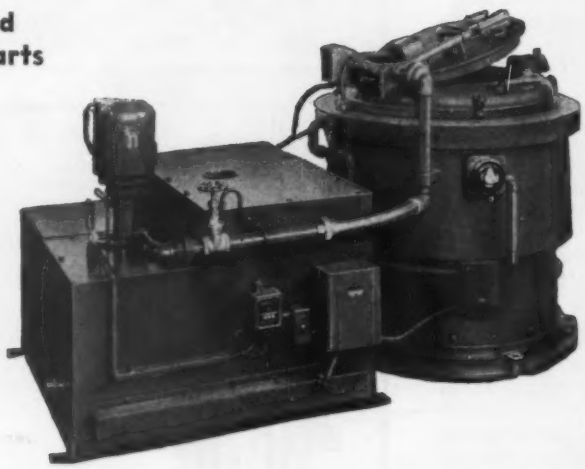

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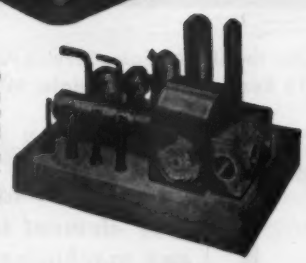

No. 2 BORING HEAD
Boring Tools and Holder provide means for boring holes up to 6" diameter, available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

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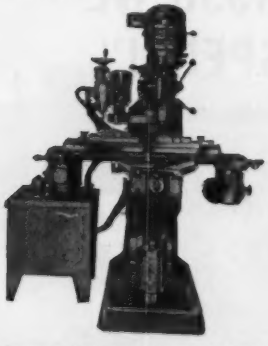

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The Bridgeport True Trace Combination gives excellent performance and saves endless hours when copying irregular dies and molds.

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Makes possible production of convex and concave shapes; ideal for producing drop forge dies, molds, cavities.

Write us or your nearest dealer for further details, specifications, etc.

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Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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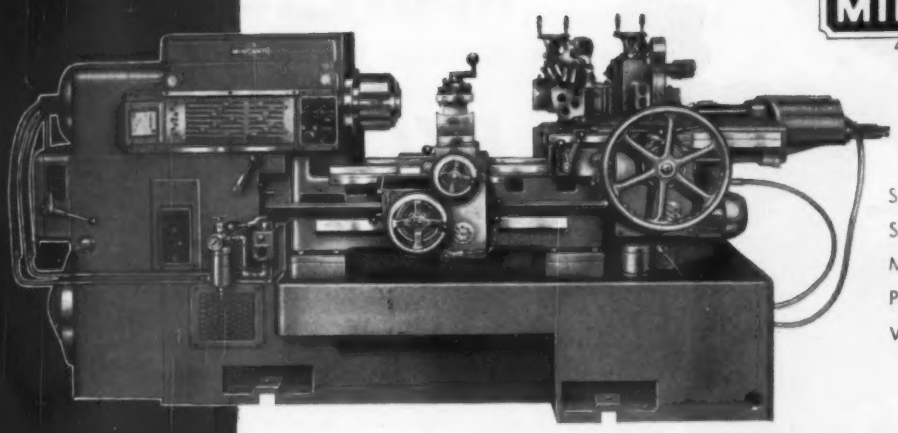

Spindle bore	2 1/4"
Swing	18"
Max speed	rpm 3000
Power	HP 8
Weight	lbs. 6000

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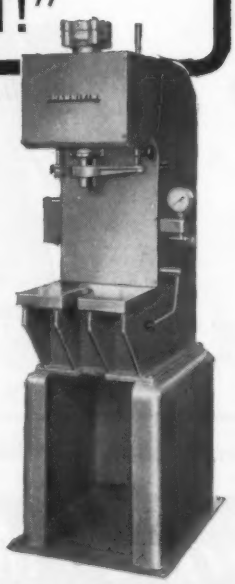

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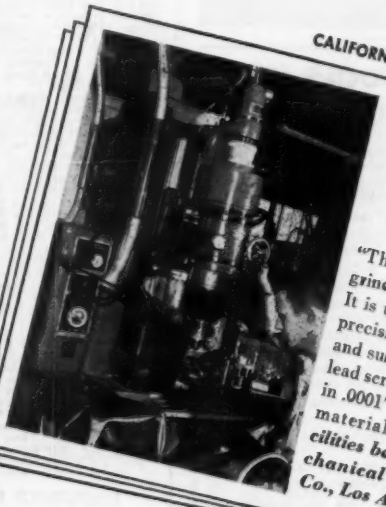

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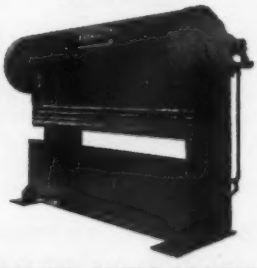

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Gaging . . .

the Surplus Machinery Market

January demand for used machine tools was definitely behind that of January a year ago, according to reports from dealers clear across the country. January, of course, is one of the year's slow months anyway, and few dealers have any real complaints—by ordinary year-in-and-year-out standards business today ranges anywhere from fair to good.

Inquiries, for one thing, are still holding up well, although dealers report prospective buyers are getting to be a good bit more choosy than they were just a few months back.

One reason, of course, is tight money. Things are going to get worse before they get better credit-wise. The squeeze is hurting the little metalworking plant more than the medium-sized plant, and the medium-sized one more than the big plant. In fact, the current tight money market has had very little effect on the big plants—seems it's easier to borrow $20 million these days than $20,000. And that's where the rub comes in for the used machinery dealer. The little plant that can't afford new equipment is now having a tough time trying to scrape up enough money to buy good used equipment.

Then again, it looks like a lot of potential buyers of machine tools are sitting back on their haunches until they see just which way the business wind is going to blow. What with top government officials, from the President and Secretary of the Treasury Humphrey on down the line all crying wolf on inflation and prices, it's no wonder buyers are cagey. A lot of them are taking a closer look at their long-range expansion and modernization programs.

Some potential customers who were buying well last year are finding their production requirements slowed. And some who are still busy are finding they can't make much of a profit on incoming orders. Result: they're not buying much until the business crystal ball clears up a little. Some dealers predict that olde.-model machine tools and fabricating equipment that couldn't be sold for love nor money a few months back, is going to start to move soon because demand for A-1 production machines is still such that some plants just can't wait for the late-model units they have on order—and because it takes proportionately less capital outlay.

But January's slowdown has had little or no effect on prices of either new or used machine tools. Really topnotch, late-model machines are still hard to find, and when a dealer does get hold of something good, the seller often as not wants an arm and a leg for it—thus putting an effective squeeze on dealer profit margins.

Newsnote from Cleveland: Motch & Merryweather, one of Cleveland's old-line new and used machinery dealers, is out of the used machinery end of the business altogether. M & M stopped buying up surplus machines for resale last July, closed its books on that phase as of January 1, and is now using the half of its plant formerly given over to rebuilding for manufacture of new cutting tools and for storage. Earl Kussuth, who headed M & M's used machinery and rebuilding operations for 29 years or so, has gone into business on his own under the name of Western Reserve Machinery Co, Brook Park Rd, Cleveland.

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EVERY TIME!

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B & S 00G Screw Threader—Vert. Slide —1950
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CLEVELAND MODEL A 1-1/16" Single Spindle

BOREMATICS
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HEALD 49 Double End—4 Heads
EXCELLO 2112A Single End

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COVEL #20 6 x 18 Hor. Hydr.
DoALL D6 6 x 18 Hor. Hydr.—Selectron —Coolant—1953
NORTON 6 x 18 Hor. Hydr.
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THOMPSON Model F 6 x 18 Hor. Hydr.

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REED-PRENTICE 20" x 78" 16-Speed

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B & O #7 2½" Ram Chucker
GISHOLT #3 1½" Ram—Bar or Chucker
GISHOLT #4 2" Ram—Bar or Chucker
GISHOLT #5 2½" Ram—Bar or Chucker
GISHOLT 2L 3½" Saddle — Taper — Threading
W & S #2 1" Ram—El. Bar Feed
W & S #3 1½" Ram—Chucker
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K & T 3H Vertical—Power Feed to Head

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CINN. 08 R & F—1951
CINN. 1-18 Plain
CINN. 2-24 Plain
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4 spindle 2" Model K Cleveland, m.d.
4 spindle Model RAS National Acme—Acme Gridley, 2" cap., m.d.
2" Cleveland Model A, single spindle, m.d.
2½" Cleveland, m.d., Model A
No. 8A Cleveland, m.d., 6" cap., latest
No. 4D Potter & Johnston, m.d.
No. 5 DELX Potter & Johnston, m.d., late

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1½" Landis 2 spindle, m.d.
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6" bar Sellers Floor Type, m.d.
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53" Niles Heavy Pattern, vee belt m.d., latest
102" Niles Wheel Turning Boring Mill

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Type SBD-46-15 American Vertical Dup. Ram Surface Hydr. Broach
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5'-14" col. Carlton, m.d.
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7'-16" col. American Triple Purpose, m.d.
8'-17" col. Dreses, gear box m.d.
Baush Radial Drilling & Tapping Machine, m.d.

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No. 15 Buffalo Floor Model, m.d.
No. ½, 1 & 2 Avey, m.d.
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No. 1B Edlund, m.d., new
No. 4BM Fosdick, single spindle, H.S., m.d.
1 spindle No. 2MA6 Avey High Speed, m.d., 7½" overhang, 1943
No. 2B—8" H.D. Edlund H.S., m.d.
2 spindle Allen, belted m.d., 8" overhang
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, Style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland-Gifford High Speed, 8" overhang, m.d.
2 spindle Leland & Gifford High Speed Hydraulic Type, m.d.
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
No. 2LMS Leland-Gifford, H.S. Hydraulic Feed, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
3 spindle Leland & Gifford #1 LMS—High Speed, m.d., late
3 spindle Leland & Gifford High Speed, m.d.
3 spindle Delta H.S., 4 speed vee pulley drive
4 spindle Leland & Gifford, m.d. on each spindle
6 spindle Leland & Gifford, m.d. on each spindle, No. 2 taper
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6 spindle Model M 1613 Pratt & Whitney In Line Vertical, m.d.

HORIZONTAL DRILLS

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3 way Natco Horizontal Drill, consisting of 3 E13 Heleonits
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Pratt & Whitney Deep Hole Sharpener, m.d.
Natco Horizontal Drill, holesteel model, m.d., 1942
Natco Horizontal Drill, 2 opposed B4F2 Heads, 1943
¾"x40" Bausch Double Horizontal Drilling Machine, m.d.

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No. 924 Barnes Vertical Drilling, Boring, Facing & Reaming Machine
6 spindle W.F. & John Barnes Vertical Drilling Machine, m.d.
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4 spindle No. 20 1¼ Barnes H.D., m.d.

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No. 2AL Natco Holesteel Vertical, m.d.
24" Aurora, m.d.
No. 2 Colburn Mfg. Type, m.d.
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No. 20 1½" Barnes Single Sp. Self-Oiling All Geared Drill & Tapper, m.d.
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EXCELLO #33 Thread Grinder 1942
NORTON Cyl. Grinder, 6x18 Plunge 1944
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ROCKFORD Hyd. Vert. Shaper, 12" st. 1944
GRAY DH Planer, 60x60x12, 4 heads, DC drive
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BIGNALL & KEELER 6" pipe threader, 1949
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36" x 36" x 12' Rockford Hydraulic Openside Planer, 40 H.P. 220/440-3-60 Motor Drive, 2 Rail Heads & 1 Side Head, Automatic Tool Lifters, Rapid Traverse, Max. Distance Table to Rail 40", Max. Cutting Speed 100 Ft. Per Min. Max. Return Speed 200 Ft. Per Min. Serial 520GA30 (1942). Replacement Cost Over $45,000.00, Our Price $27,500.00.

PARTIAL LISTING BORING MACHINES

Foote-Burt Vert. 16" sw. new 1941
#49 Heald Borematic, new 1944
3¼" Bar Cinn.-Gilbert Floor Type

DRILLS

1 spdl. 14" sw. #7 Avey, new 1945
1 spdl. 20" sw. #4LMS L-G, 1945
1 spdl. 24" sw. #2MA6 Avey, new 1942
1 spdl. 26" sw. #4MS L-G hydraulic
2 spdl. 24" sw. #3 Avey, AC MD
3 spdl. 20" sw. #2LMS L-G, 1942
3 spdl. 24" sw. #3MS L-G, new 1943
6 spdl. 20" sw. #1LMS L-G, new 1943
15 Ton, 60" Stroke, Colonial Vert. Broach
16 spdl. Fox #K60H, #2 taper, 1944

GRINDERS

3"x12" #5 B&S, 1942
3"x18" #5 B&S, 1942
4"x12" #4H Landis, new 1942
6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1941
10"x36" Norton Type C, new 1942
10" (28" sw.) x 48" Cinn. ER, 1943
10"x50" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"x20"x36" Norton, angular wheel
14"x72" Norton Type C, new 1941
14"x96" Hill-Clarke, AC Mot. Dr.
16"x20"x96" Norton, 1942
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, AC Mot. Dr.
16"-20"x72" Norton, AC MD 1941
18"x120" Norton, AC MD
20"-32"x144" Norton Pl. Cyl.
23"x36" Norton, Hi-Swing
24"x264" Norton, AC MD
42"x72" Norton, extras, new 1947
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc. 1940
3B Abrasive Surf. 8"x24", 1943
#18-30" Blanchard Rot. Surf.

LATHES

16ML-16"x36" LeBlond Auto.
12"x30" Handey Lathe, Taper Att.
12"x28" Lipe Carbo Semi-Auto
12"x33" Fay Automatic
12"x45" Fay Automatic
27"x84" Amer. Grd. Hd., MD
24"x42" Fay Auto. AC MD
36"x126" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96" oc N-B-P, ser. 3330
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1942
#4A W&S Turret Ser 238969
4FU Fastermatic, tur. 32" sw. 1944
8D Potter & Johnston, new 1941

MILLERS

54"x30"x16" Ingersoll Slab, 1934
54"x60"x8" Ingersoll Openside, 1942
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B. Thread Mill
#LT 6"x72" L B Thread Mill
#HT 12"x24" L-B Thread, 1942
#CT 24"x36" L-B Thread, 1942
No. 2 Cinn. Univ. Hi-Power
#1.8 Van Norman Prod. 1942

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30" Hamilton, 4 heads

MISCELLANEOUS

6" Goss & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 2 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" cam
#HR8 Barber-Colman Sharp Mach
No. 2 Pfauter Gear Hobber

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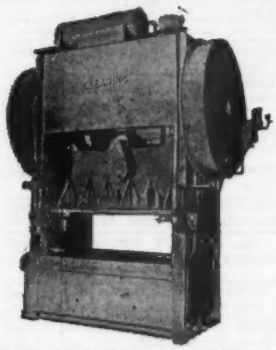

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GRINDERS No. 36 Hanchett 36" vert. Rotary '44
30" Blanchard No. 16 Vert. Rotary
36"x42" Pratt & Whitney Vert. Surf. '47
60" Hanchett Vert. Spin. Surf. No. 300, Rec.
10"x20" B. & S. No. 1 Univ. '42.
LATHES 25" x 48" cen. LeBlond, 31" sw. '41.
36"x21' Cen. N.B.P. Grd. Hd.. M.D.
16"x78" Cen. Sidney, T.A., 18½" SW.. '52.
TURRETS Nos. 3AL, 2L, 5 & 3 Gisholts.
Nos. 2 W. & S. & 2 & 2G Moreys
MILLERS No. 2 Cinci. Dial Type Univ. '45.
No. 4B K. & T. Vert.—Table, 102"x19" oversize.
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Bliss No. 5½-48W, cap. 120 ton, Bed 48"x30".
Bliss-Toledo No. 93½J, cap. 140 tons, Bed 100"x 48".
Bliss 93½ H. Bed 84"x30", cap. 140 tons.
Bliss No. 27-84, Gap Frame, cap. 200 ton, Bed 24"x100".
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COLONIAL Model VGI 10-48 Stroke Vertical, hyd.
LAPOINTE No. 3 Double Spindle, M.D.
LAPOINTE Model SRV 10-54 Stroke Vertical; hyd.
LAPOINTE SRV 15/66" Stroke Vertical hyd., late

DRILLS, RADIAL
AMERICAN 7' arm 16" Column Plain; motor drive
CINCINNATI BICKFORD 4' arm 11" Column Plain; "Super Service"; motor on arm
CINCINNATI BICKFORD 5' arm 13" Column Plain
MORRIS 3' arm 11" Column Plain; late type

GEAR EQUIPMENT, MISCELLANEOUS
BILGRAM 6" Bevel Gear Generator; 1 D.P.; M.D.
BILGRAM 16" Bevel Gear Generator; 2 D.P.; M.D.
BROWN & SHARPE No. 13 Straight & Bevel Auto. Gear Cutter; 18" cap., 4 D.P., M.D.
CINCINNATI No. 4 Auto. Gear Cutter; cap. 36"; 2½ D.P.; late type
CINCINNATI No. 8A Auto. Gear Cutter; cap. 72"; 1½ D.P.; late type
CROSS No. 1 Gear Tooth Rounding Machine; cap. 4 pitch or finer to 24" dia.; 2 pitch or finer to 6" dia.
CROSS No. 40 Gear Tooth Pointing & Chamfering Machine; gear face 10", gear dia. 20"
CROSS No. 45 Gear Chamfering Machine; late type
DETROIT Type GG-35 Gear Grinder; late type
FELLOWS #645A3 Gear Shaper; late type
GOULD & EBERHARDT No. 36BM; 3-Spindle Gear Rougher; 2 D.P.; M.D.
GOULD & EBERHARDT No. 36BT Gear Rougher; 4 D.P.; M.D.
MICHIGAN Model 802-24A Gear Finishing Machine
MICHIGAN Model 854 Rack Type Gear Shaver; 8" dia.; 2" Face; M.D.
PRATT & WHITNEY 10" Gear Grinder; single wheel type; cap. 10-11/16"
ROBEY SMITH No. 1 Straight Bevel Gear Planing Machine; M.D.
SHEFFIELD (Cimatool) No. 201A Auto. Burring Machine; late type

KANE & ROACH "Ohio" Cold Roll Forming Machine; late type.

GEAR EQUIPMENT—HOBBING
BARBER COLMAN Type A; cap. 12"x12" 3 D.P.
BARBER COLMAN Type S Auto. Gear Hobbing Machine No. 1 1" dia. Brass 24 D.P., steel 32 D.P.
BARBER COLMAN Type T; 12"x12" cap.; 3 D.P.
BARBER COLMAN Model 8-10 Model (type V) Vertical; cap. 8"; 4½ D.P., late type
BARBER COLMAN No. 17 cap. 8"; 2½ D.P.; M.D.
GOULD & EBERHARDT No. 8H Universal; cap. 12"; 4 D.P., M.D.
GOULD & EBERHARDT Model 24-H Universal 27" cap; 3½" D.P., late type
GOULD & EBERHARDT 12H Heavy Univ. cap. 12"; 4 D.P., M.D.
KOEPFER Model WM-11 Automatic Gear Cutter; 24 D.P., late type

GRINDERS, PLAIN CYLINDRICAL
CINCINNATI 4"x12" Centers Model GH "Filmatic"; New 1950
LANDIS 4"x12" Centers Type H Hyd., late type
LANDIS 6"x16" Centers; M.D.
LANDIS 10"x36" Centers Type DC Heavy Hyd.
LANDIS 10"x36" Centers; M.D.
LANDIS 10"x72" Centers Type DC Heavy Hyd.
LANDIS 10"x96" Centers Type C Hyd., late type
LANDIS 16"x120" Centers, Type B; late type
NORTON 4"x12" Centers Type CTU Hyd., 1951
NORTON 10"x16" Centers Type C Hyd.; late type
NORTON 10"x36" Centers; Motor Drive
NORTON 10"x48" Centers Type C Hyd.; late type
NORTON 14"x72" Centers Type C; late type
NORTON 14/22"x36" Centers Type C "Gap Type"
NORTON 16"x48" Centers Type C; late type

GRINDERS, SURFACE
HEALD No. 22 Rotary Surface Grinder 12" Chuck
HEALD No. 25A Rotary Surface Grinder 20" Chuck
MATTISON 14"x16"x80" High Power "Precision" Hyd.; late tye
MATTISON 14"x24"x72" High Power "Precision"
NORTON 6"x18" Horizontal Spindle Hydraulic; late
NORTON 6"x18" Vertical Spindle Hydraulic; late
PRATT & WHITNEY 14"x36" Vertical Spindle Hydraulic; late type
GALLMEYER & LIVINGSTON No. 45 cap. 12"x24"

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LATHES
LEBLOND 24x96 Regal; late type
LEBLOND 24x84 Regal; late type

LATHES, TURRET
GISHOLT No. 1L Univ. Saddle Type; Swing 19"
GISHOLT No. 2L Saddle Type Swing 22½"; cross sliding turret; late type
GISHOLT No. 4 Ram Type; Swing 30"; late type
GISHOLT No. 5 Univ. Ram Type Preselector Head; Swing 19¾"; late type
LIBBY (INTERNATIONAL) Model 4H-12 Saddle Type; Swing 32"; cross sliding turret
MOREY No. 2 Ram Type; Swing 14"; late type
MOREY No. 3 Univ. Ram Type Swing 16½"; late type
MOREY No. 4 Univ. Ram Type Swing 19½"; late type
WARNER & SWASEY No. 1 "Electric"; swing 11"
WARNER & SWASEY No. 1A Univ. Saddle Type; Swing 18"; late type
WARNER & SWASEY No. 2A Univ. Saddle Type; Swing 21½"; late type
WARNER & SWASEY #4A Univ., late type
WARNER & SWASEY No. 4 Univ. Ram Type Preselector Head; Swing 19½"; for Bar or Chucking

MILLERS, PROFILE AND DUPLICATING MACHINES
CINCINNATI #3-4 Plain Miller, late type
MOREY 12M 2 spindle Vertical Profiler & Miller; table 12"x15"; late type
PRATT & WHITNEY GG "Keller" Auto Toolroom Machine; table 18"x18"; late type
PRATT & WHITNEY Model BL-2418 "Keller" Auto Tracer Control Miller; 3 dimensional; 3 spindle; 22"x42"; late type

PLANERS
DETRICK & HARVEY 48" x 48" x 16' Double housing; Hyd.; 4 heads; M.D.
GRAY 48" x 48" x 10' Double housing; 4 heads; D.C.; M.D.
LIBERTY 144" x 76" x 48' Convertible openside; 4 heads; vari-voltage
NILES 48" x 48" x 10' Double housing; 4 heads; D.C.; M.D.
NILES BEMENT POND 60" x 60" x 14'; Double housing; 4 heads; D.C.; M.D.
NILES BEMENT POND 72" x 72" x 30' Double housing; 4 heads; vari-voltage; M.D.
NILES BEMENT POND Horizontal, 36" x 36" x 14' Double housing; 4 heads; M.D.
SELLERS 48" x 48" 14' Double housing "Power-Flo"; 4 heads; D.C.; M.D.
SOUTHWARK #1 Horizontal Plate Edge; cap. 1½ x 16 ft.; M.D.

SCREW MACHINES, AUTOMATIC BAR OR CHUCKING
BROWN & SHARPE No. 00G—Auto. Cap. ⅝" Round; late type
CLEVELAND 1¾" Model A Single Spindle Auto.
CLEVELAND 3¼" Model A Single Spindle Auto.
CLEVELAND 7¼" Model A Single Spindle; Auto.
CONOMATIC 1⅞" 6-Spindle Automatic; late type
CONOMATIC 4⅜" 4-Spindle Automatic; late type
NEW BRITAIN GRIDLEY Model 65 — 6-Spindle Automatic Chucking; late type
GREENLEE 1-5/8" Six-Spindle Automatic; late type
GYROMATIC "TAVANNES" No. 40 6-Spindle Auto.
CONOMATIC 1⅝" 6-Spindle Automatic; late type
CONOMATIC 1⅝" 6-Spindle Automatic; late type
CLEVELAND 1½" Model A; 4-Spindle Automatic
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GREENLEE 1¾" 6-Spindle Automatic; late type
POTTER & JOHNSTON #4D Automatic late type

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24", 36" BULLARD Vertical Turret Lathe, Turret Hd., Side Hd., M.D.

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17" x 8' LeBlond Regal Grd. Hd. Lathe, M.D.

No. 11 GISHOLT Univ. Turret Lathe, Gross Sliding Turret, M.D.

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28" BARNES Upright Drill Press No. 242 M.D. Box Column, Power Feed.

3', 5', 6' CINCINNATI BICKFORD Radial.

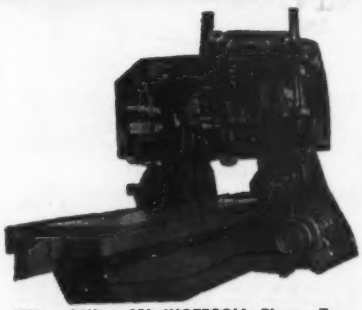
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press. Individual Motor Drive. Late Type

MILLS

0-8 CINCINNATI Horizontal & Vertical Prod. Mills, M.D.

No. 2HL KEARNEY & TRECKER Horiz. Mill, M.D., Late Type.

6 Spindle LELAND GIFFORD No. 2LMS-20" Drill Press. Excellent Condition.



42" x 36" x 12' INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late

48" CINCINNATI Duplex Automatic Prod. Mill, M.D.

No. 2, 3, 4, 5 CINCINNATI Hi Power Horiz. Mills, M.D.

PRESSES

No. 6 BLISS Straight Side Press Double Crank 135 Tons Cap., Motor Driven.

400 Tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support, M.D.

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GRINDERS

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6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

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No. 194 BARNES Vertical Hone, 4" Capacity, 12" Stroke, M.D.

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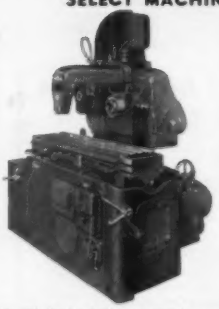

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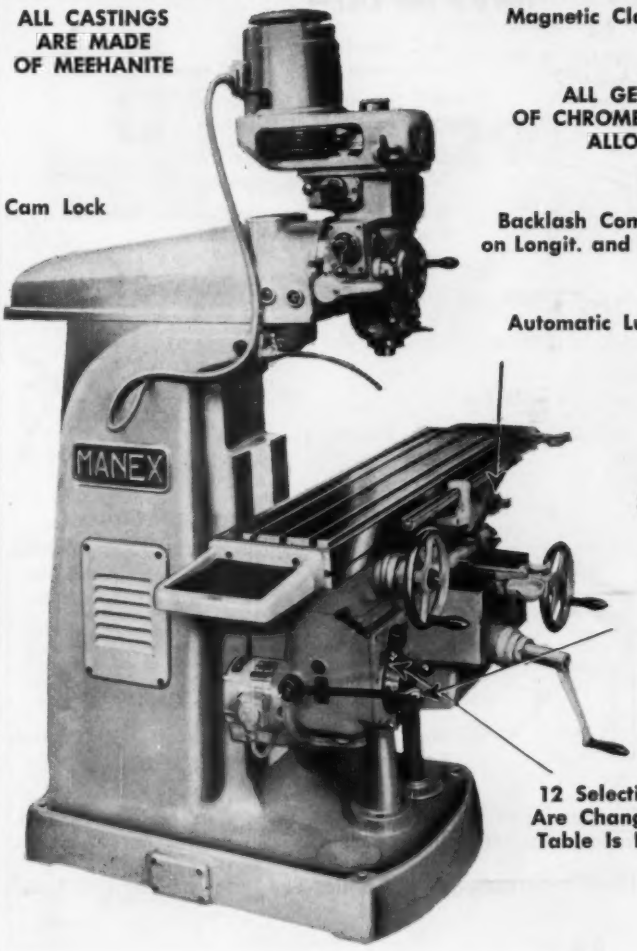
MANEX

High Speed Vertical Milling Machine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Backlash Compensation on Longit. and Cross Feeds
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MANEX
SADDLE 30" Long
Rapid Traverse
12 Selective Feeds Are Changed While Table Is In Motion

SPECIFICATIONS

TABLE	36" - 42" - 48"	Electro-pump	¼ H. P.
Longitudinal feed	26" - 30" - 38"	Maximum distance spindle to table	18"
Width	10"	Maximum distance spindle to column	25"
Cross feed	10"	12 DIAL TYPE table feeds	7/16" to 19⅛"
8 Spindle speeds	75-2850 r. p. m.	RAPID TRAVERSE	100" p. m.
3 automatic feeds	.0015" - .003" - .006"	Micrometer depth stop graduated in .001"	
Quill travel	5"	Large dials graduated in .001"	
Head traverse travel	13"	Brake inside pulley stops spindle instantly	
Motor for Spindle	2 H. P.	Motor and pulley dynamically balanced.	
Motor for table feed	½ H. P.	Net weight (approx.)	2750 Lbs.
Saddle	30"	Base	40" x 25"

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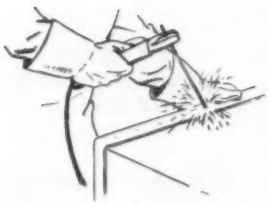

A-C Transformer Type
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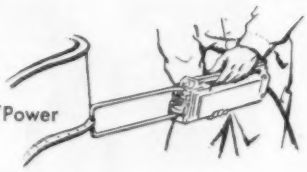

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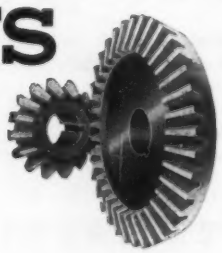

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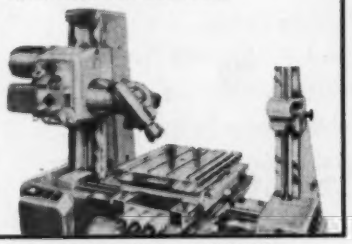

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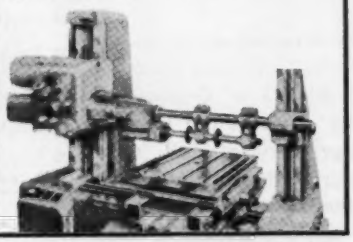

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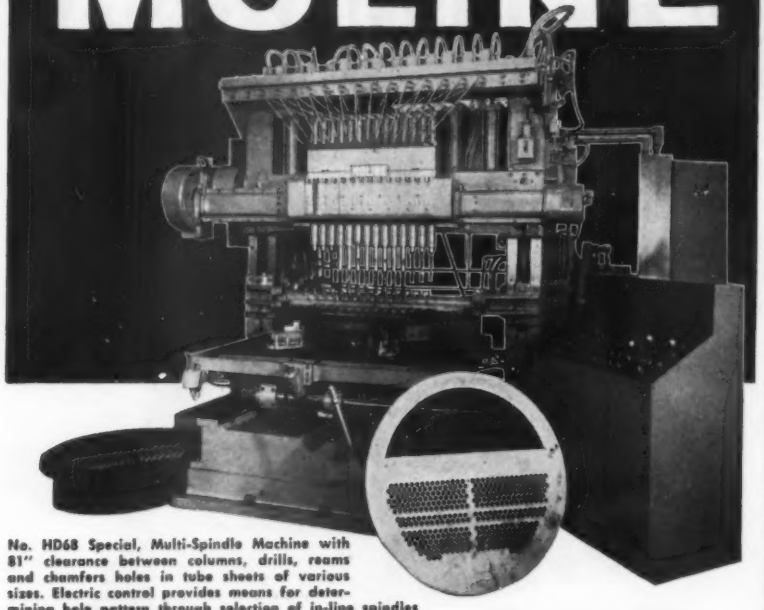

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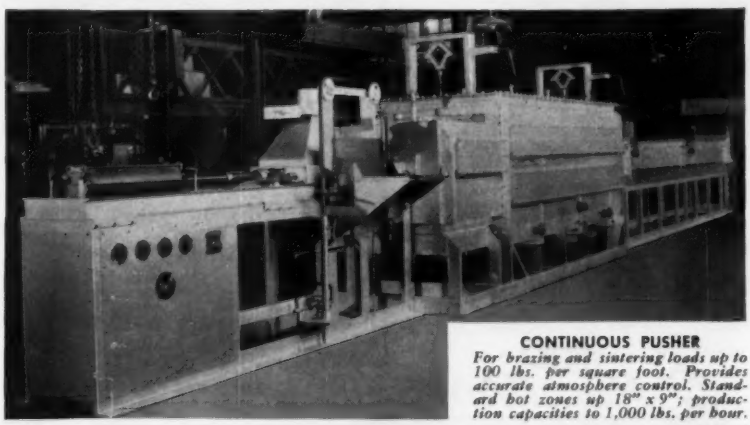

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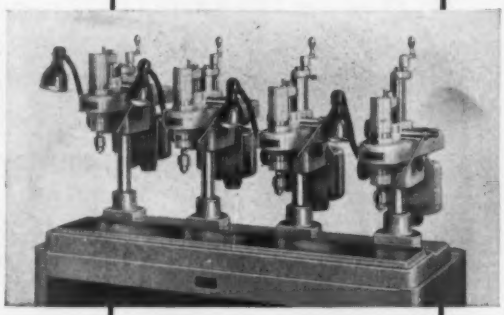

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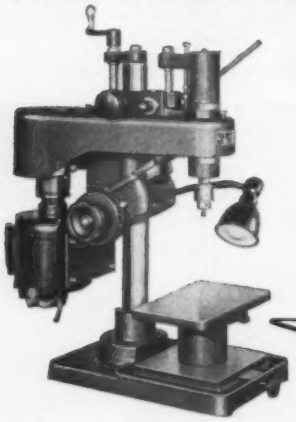

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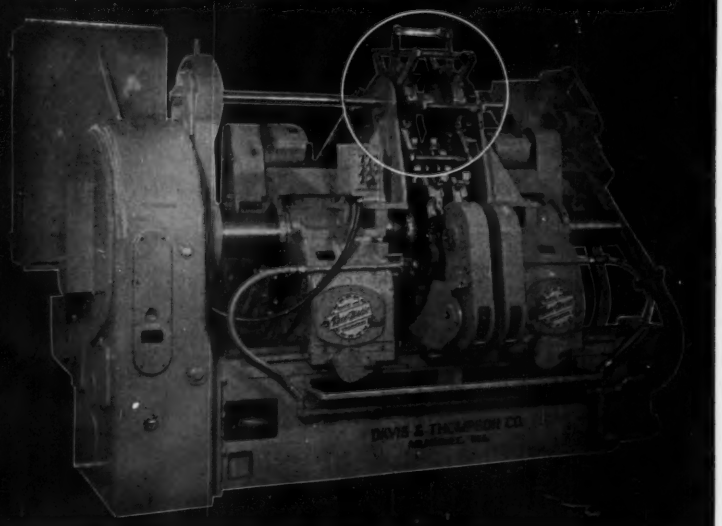

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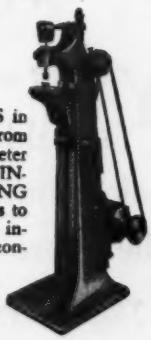

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San Francisco 4 . . . R. C. Alcorn, 68 Post St., Douglas 2-4600

England . . . Herbert Lagler, McGraw-Hill House, 95 Farringdon St., London, E. C. 4

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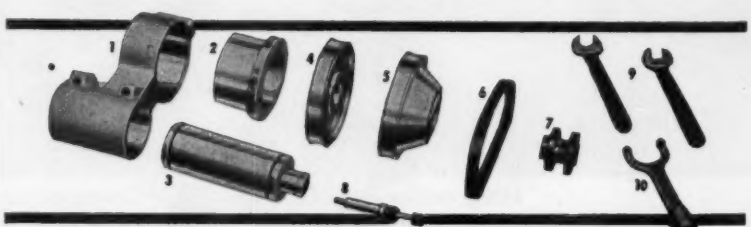
X Multiply the use of your surface grinder. . .

+ Add a *Whitnon*

HIGH SPEED ATTACHMENT

Most 6x18 surface grinders can now be used to finish small radii on dies or parts requiring small contour grinding by merely adding a Whitnon high speed surface grinder attachment. This assembly, in effect, creates an extra machine at little cost and increases the production range of your present grinder.

Whitnon surface grinder attachment comes as a complete kit, and can be shipped in a fitted wooden case. The offset pulley No. 5 makes it possible to reach into deeper holes and recesses than the flat pulley. Tapered arbors up to 4" in length available for direct wheel mounting if required.



1. Bracket 2. Eccentric bushing 3. 20,000 RPM grease lubricated spindle 4. Flat pulley 5. Offset pulley 6. Belt 7. Wheel & pulley mount 8. Collet type arbor 9. Arbor wrenches 10. Wheel & wheel mount wrench

THE *Whitnon* MANUFACTURING COMPANY
ROUTE 6 AND NEW BRITAIN AVE., FARMINGTON, CONNECTICUT

MODEL D

SHORE SCLEROSCOPE HARDNESS TESTERS

Pioneer American Standard SINCE 1907

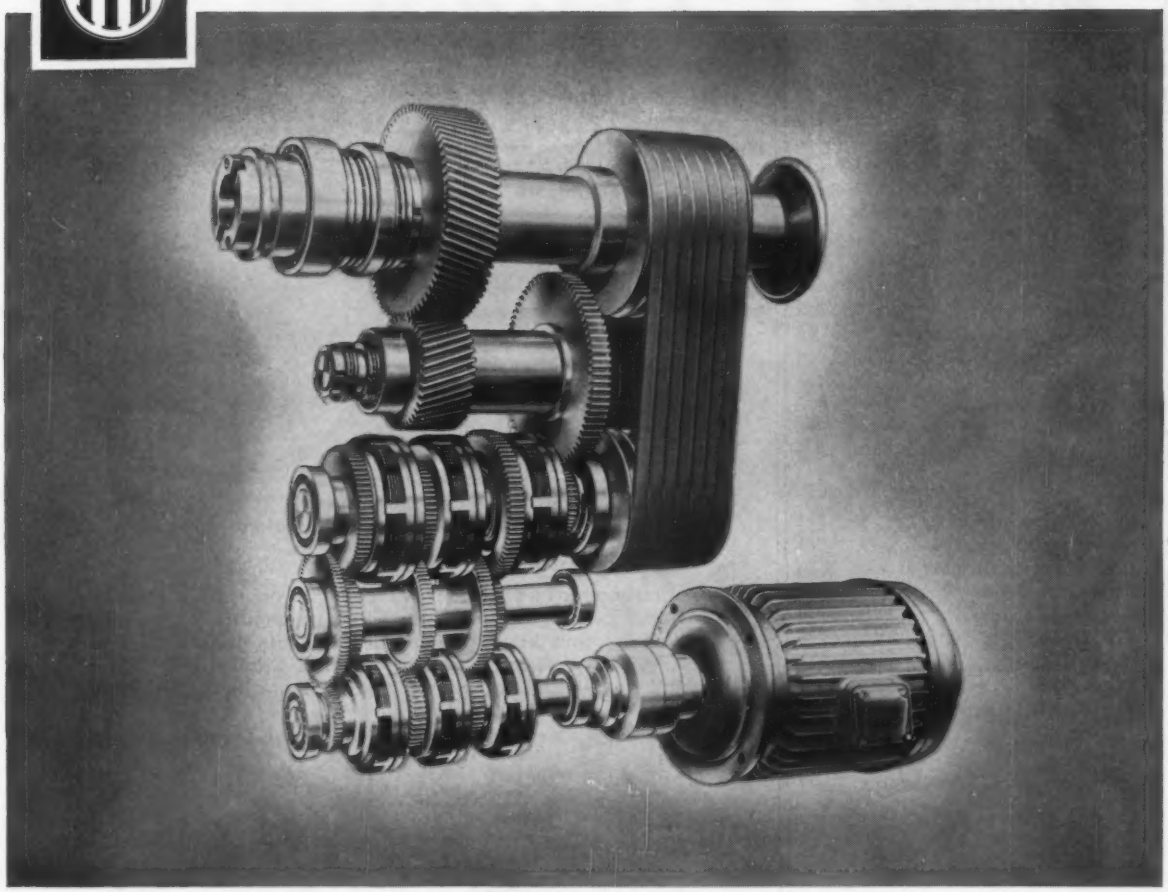
Available in Model C-2 direct reading or in Model D dial indicating with equivalent Brinell and Rockwell C Hardness Numbers. May be used free hand or mounted on bench clamp. Sensitive over entire range from softest to hardest of metals without adjustment. Non-injurious to work.

OVER 40,000 IN USE

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35B Van Wyck Exp.
Jamaica 35, N. Y.

MODEL C-2

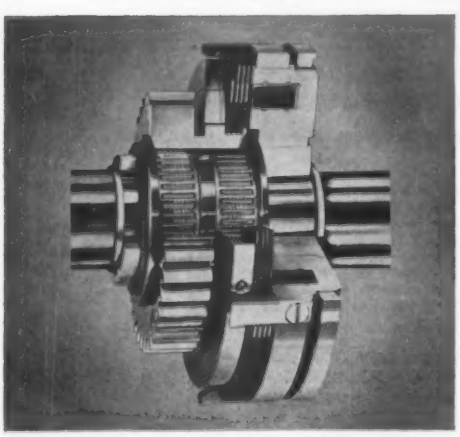
ELECTRO CLUTCHES



Milling machine drive using six I-T-E Electro Clutches and providing a total of nine speeds and braking. High-low range is attained by use of one slide gear.

CHANGE SPEEDS OR FEEDS ON THE FLY

by push button, limit switch, relay



Type H design showing unit construction.

FEATURES:

• No adjustments required for wear • Simply and easily installed • Positive operation • No complicated wiring • Fast response • Cushioned operation—no shock loading of gears or shafts

Tapered torque ratings from 3.2 to 13,000 lb.-ft. make possible the selection of the correct I-T-E Electro Clutch for the application. For complete data, write for Bulletin 5306.

I-T-E Circuit Breaker Company, Transformer & Rectifier Division, 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY
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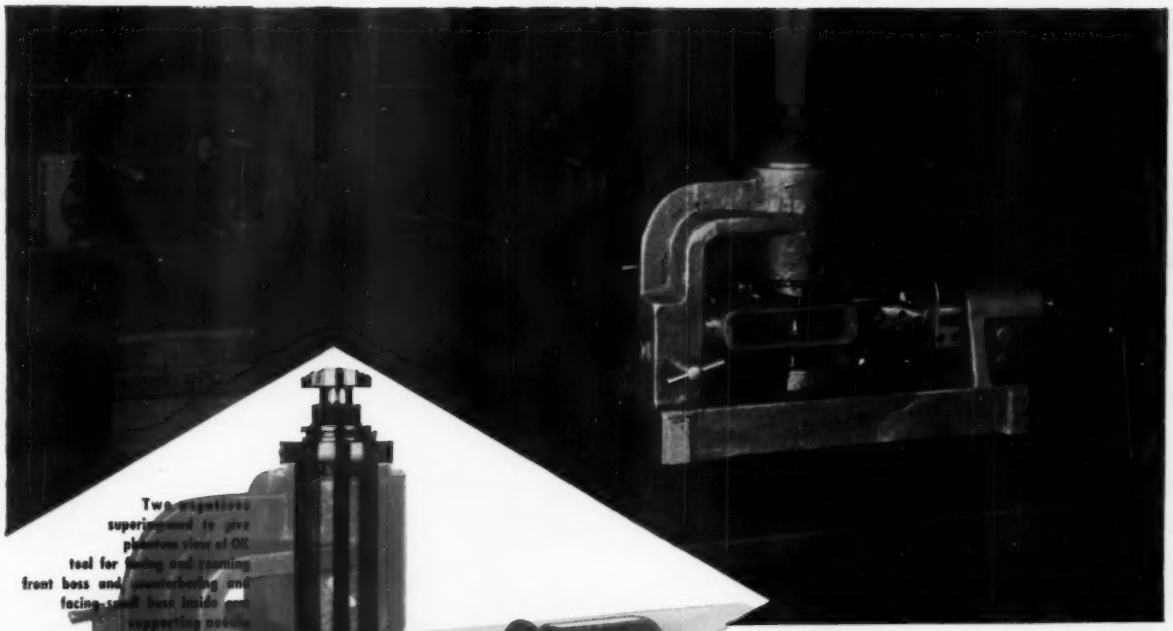
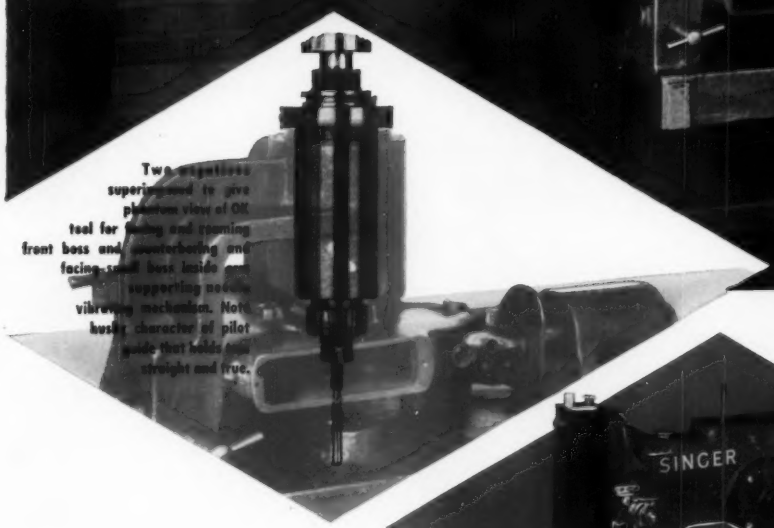
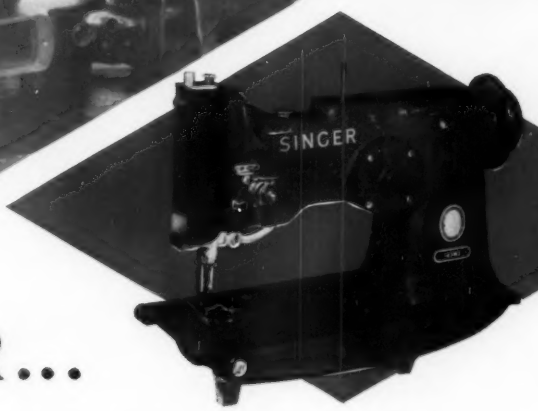




Two ingenious superimposed to give plan-form view of OK tool for [illegible] and reaming front boss and counterboring and facing small boss inside [illegible] supporting nosing vibrating mechanism. Note bushing character of pilot guide that holds part straight and true.



Singer Sewing Machines, Class 143W, are [illegible] industry for over stitching [illegible] binding awnings, [illegible] goods and [illegible] garments, shoe linings, [illegible] ades and [illegible] ching lace, applique, flag stars, etc.

at SINGER...

four operations with one stroke...+

JOB DATA

Operating speed...
145 rpm

Feed...
.013 feet per revolution

Depth of cut...
facing, 3/32"
reaming, 3/8"

Before Singer acquired these OK two-step piloted reaming and facing tools, downtime ran high. After 300 pieces, tools were out for grinding. Now they get 750 pieces before grinding, an increase of 150 per cent. One man works two spindles, producing 50 units per hour without pushing and maintains tolerances plus and minus .001". Workpiece is a sand molded grey iron casting, not the easiest material to machine. This is one of dozens and dozens of high speed steel and carbide bladed multiple-diameter tools OK has made for Singer. OK tool designing and engineering service is free and it's fast. If you have a tooling problem, why not talk to us about it. Just send us a blueprint, sample or picture with information as to the material, quantities, machines and horsepower available. In a week you will receive a print for approval and in another two weeks the actual tool will be making chips fly.

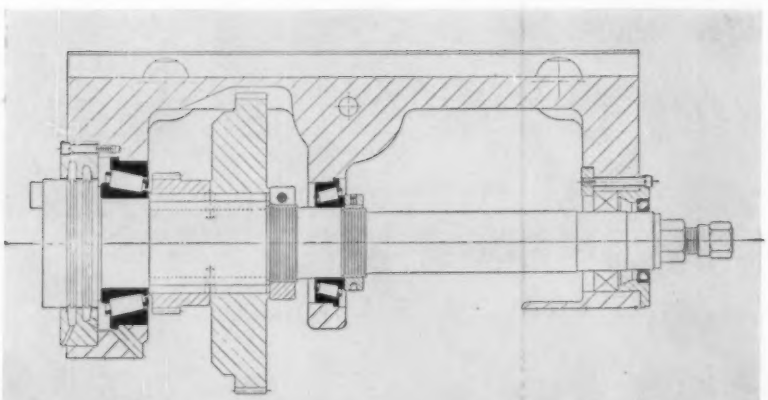
FREE — 52 page book of Blueprints of actual multiple-diameter tools designed for combination milling, boring, counterboring, facing and chamfering with one stroke or pass.

THE OK TOOL COMPANY • 400 Elm Street • Milford, New Hampshire

modern milling cutters *for* modern milling machines

multi-diam tools • reamers • boring heads • form cutters

New! Completely redesigned milling machine switches spindle to TIMKEN® bearings



KEMPSMITH MACHINE COMPANY mounts the spindle of their new Kempsmith Master-Mill milling machine on Timken tapered roller bearings to hold spindle in rigid alignment.

THIS Kempsmith Master-Mill, made by Kempsmith Machine Company, is a brand new, improved model—designed to meet new demands for higher production, lower milling costs. Kempsmith switched to Timken® tapered roller bearings on the new Kempsmith Master-Mill to offer users their many advantages on the spindle, on the table leadscrew, on elevating pinion, and cross feed screw.

Kempsmith reports that Timken bearings are easier to install and adjust, have greater load capacity in small space, are much easier to preload.

Timken bearings hold the spindle in rigid alignment, meeting the requirement of "zero end play over a 24 to 1500 rpm speed range." Tapered construction lets Timken bearings take the radial and thrust loads encountered by a milling machine spindle, in any combination.

Timken bearings were specified, too, because of the heavy shock loads induced by the milling cutter—shocks further amplified by interrupted cuts. Rollers and races in Timken bearings are case-carburized, with tough, shock-resistant cores under hard wear-resistant surfaces. They'll *take* heavy shock loads! And Timken bearings give extra load-carrying capacity with their full line contact between rollers and races.

Geometrically designed for true rolling motion, Timken bearings are precision-manufactured, under rigid quality controls, to conform to their design. We even make our own steel, something no other American bearing maker does. Buying or building machines like this? Look for the trade-mark "TIMKEN" on every bearing! The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD